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***December 20, 2005***

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**DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION**

**PERFORMANCE SPECIFICATION**

**MEDIUM INTENSITY  
APPROACH LIGHTING SYSTEM  
WITH  
RUNWAY ALIGNMENT INDICATOR LIGHTS  
(MALSR)**

**Lighting Systems Navigation Group (AJW-46)  
Technical Operations Navigational Services Office**

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**1. SCOPE**

This specification establishes requirements for the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR).

**2. APPLICABLE DOCUMENTS**

**2.1 General**

The documents listed in this Section are referenced in Sections 3 and 4 of this specification.

**2.2 Government Documents**

**2.2.1 Specifications, Standards, and Handbooks**

The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS).

**2.2.2 Specifications**

**2.2.2.1 Federal Aviation Administration (FAA)**

FAA-E-1100a	Photometric Test Procedures for Condenser-Discharge Lights
FAA-G-2100g	Electronic Equipment, General Requirements
FAA-E-2604	Low-Impact Resistant Structures for Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR)
FAA-E-2628	Sequenced Flashing Light System, Elevated and Semi-Flush with Dimming and Monitoring
FAA-E-2702	Low-Impact Resistant Structures, Specification for
FAA-E-2968	Steady Burning, Semi-Flush, Approach Light Units for the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR)

**2.2.2.2 Federal**

**2.2.2.3 Department of Defense (DoD)**

MIL-PRF-27F	Transformers and Inductors (Audio, Power, and High Power Pulse), General Specification for (includes Supplement 1, 2/25/2001)
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**2.2.3 Standards**

**2.2.3.1 Federal Aviation Administration**

FAA-STD-019d Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment

**2.2.3.2 Federal**

FED-STD-595B Colors Used in Government Procurement

**2.2.3.3 Department of Defense**

MIL-STD-810F Test Method Standard for Environmental Engineering Considerations and Laboratory Tests

MIL-STD-461E Requirements for Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

**2.2.4 Handbooks**

**2.2.4.1 Department of Defense**

MIL-HDBK-470A Designing and Developing Maintainable Products and Systems

MIL-HDBK-781A Handbook for Reliability Test Methods, Plans, and Environments for Engineering, Development, Qualification, and Production

(Copies of the above Federal and DoD specifications, standards, and handbooks are available from the Department of Defense Single Stock Point (DoDSSP), 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5098. Electronic copies of the above Federal and DoD specifications, standards, and handbooks are available from the DoDSSP on the Internet at <http://dodssp.daps.mil>.)

(Electronic copies of some of the above FAA specifications and standards are available on the Internet at <http://www1.faa.gov/asd/standards/index.htm>. Copies of all the above FAA specifications and standards are available by following the *Guide to Federal Aviation Administration Publications*, FAA-APA-PG-10, which is available from the US Department of Transportation (DoT), M-443 .2, Washington, D.C. 20590, Phone: 202-366-0039 (info only), Fax: 202-366-3911 (for requests).)

**2.2.5 Other Government Documents, Drawings, and Publications**

The other government documents, drawings, and publications that follow are part of this document to the extent specified herein. Unless specified otherwise, the issues are those cited in the solicitation.

<b>2.2.5.1</b>	<b>Federal Aviation Administration Drawings</b>
C-6046	Frangible Coupling, Type 1 and 1A, Details
D-6155-2	ALSF-2 (6'-128') and MALSR (40'-128') LIR Structures, Light Mounting Height 6'-1" - 128' Tee-Bar, and Tube Cap Assemblies
D-6213-15	MALSR with Threshold lights and Low-Impact Resistant Structure, 40'-0" to 128'-0" Mounting Height, LIR Wiring
D-6292-5	FA-11500 MALSR with RMS - Power and Control Station Equipment Exterior Mounting Details
D-6292-7	FA-11500 MALSR with RMS - Threshold Light Details
D-6292-8	FA-11500 MALSR with RMS - Semi-Flush Lights, Details for Runway Overrun Installation
D-6292-9	FA-11500 MALSR with RMS - Up to 6'-0" Mounting Height Frangible Light Bar
D-6292-13	FA-11500 MALSR with RMS - 40'-0" to 128'-0" Mounting Height LIR Wiring
D-6292-14	FA-11500 MALSR with RMS - Low Impact Resistant MG Structure Configurations
D-6292-19	FA-11500 MALSR with RMS - Optional MALSR Concrete Shelter Requirements

(Electronic copies of some of the above FAA publications are available on the Internet at <http://www1.faa.gov/asd/standards/index.htm>. Copies of all the above FAA publications are available by following the *Guide to Federal Aviation Administration Publications*, FAA-APA-PG-10, which is available from the US DoT, M-443 .2, Washington, D.C. 20590, Phone: 202-366-0039 (info only), Fax: 202-366-3911 (for requests).)

### **2.3 Non-Government Publications**

The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DoD adopted, are those listed in the issue of the DoDISS cited in the solicitation. The issues of the document which are not DoD adopted, are the issues in effect at the time of solicitation

<b>2.3.1</b>	<b>National Fire Protection Association (NFPA)</b>
NFPA No. 70	National Electrical Code – 2002

- 2.3.2 National Electronics Manufacturing Association (NEMA)**  
NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- 2.3.3 American Society for Testing and Materials (ASTM)**  
E308-01 Standard Practice for Computing Colors of Objects Using the CIE System
- 2.3.4 Society of Automotive Engineers (SAE)**  
SAE - AS25050 Colors, Aeronautical Lights, and Lighting Equipment, General Requirements for
- 2.3.5 International Commission on Illumination (CIE)**  
DS010.2 Photometry – The CIE System of Physical Photometry  
CIE 127-1997 Measurement of LEDs
- 2.3.6 Institute of Electrical and Electronics Engineers (IEEE)**  
C62.45-2002 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits
- 2.3.7 International Civil Aviation Organization (ICAO)**  
Annex 14 – 1999 Volume I – Aerodrome Design and Operations

(Unless otherwise indicated, copies of the above National Fire Protection Association publications are available from NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA, 02269-9101. Electronic copies of the above publications are available on the Internet at <http://www.nfpa.org>.)

(Unless otherwise indicated, copies of the above National Electronics Manufacturing Association publications are available from NEMA, 1300 N. 17<sup>th</sup> St, Suite 1847, Rosslyn, VA, 22209. Electronic copies of the above publications are available on the Internet at <http://www.nema.org>.)

(Unless otherwise indicated, copies of the above American Society for Testing and Materials publications are available from ASTM, 100 Barr Harbor Drive West, Conshohocken, PA 19428-2959. Electronic copies of the above publications are available on the Internet at <http://www.astm.org>.)

(Unless otherwise indicated, copies of the Society of Automotive Engineers publications are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Electronic copies of the above publications are available on the Internet at <http://www.sae.org>.)

(Unless otherwise indicated, copies of the International Commission on Illumination publications are available in the United States from TLA-Lighting Consultants, Inc., 7 Pond Street, Salem, MA 01970.)

(Unless otherwise indicated, copies of the Institute of Electrical and Electronics Engineers publications are available from 10662 Los Vaqueros Circle, P. O. Box 3014, Los Alamitos, CA 90720-1264, (800)-272-6657. Electronic copies of the above publications are available on the Internet at <http://www.ieee.org>.)

(Unless otherwise indicated, copies of the International Civil Aviation Organization are available from: Document Sales Unit, 999 University Street, Montreal, Quebec, Canada H3C 5H7, (514) 954-8022. Email: [sales\\_unit@icao.int](mailto:sales_unit@icao.int).)

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### 3. REQUIREMENTS

#### 3.1 MALSR System Description

The Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) provides visual guidance to landing aircraft. The equipment is installed and operated in the approach area of an active landing runway.

The MALSR system consists of three approach guidance light arrays:

1. Threshold Light Array,
2. Steady Burning Light Array,
3. Sequenced Flasher Array.

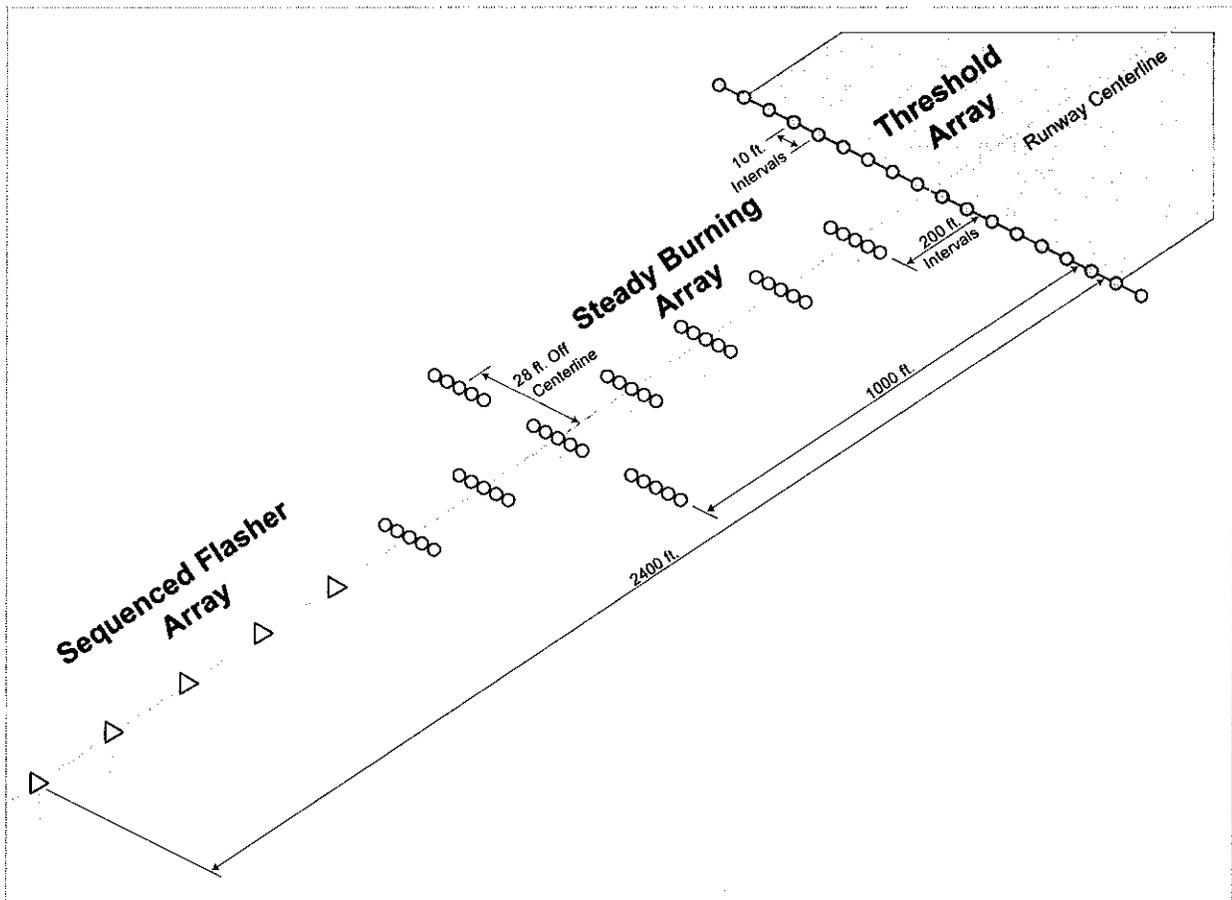
The threshold light array consists of 8 to 33 aviation green steady burning light sources, depending on runway width, arranged in a line at and parallel to the threshold of the runway. The steady burning light array consists of nine (9) sets of five (5) aviation white steady burning light sources called light bars. Seven (7) of the light bars are located at 200-foot intervals, in the direction of the approach and along the extended runway centerline, starting beyond the runway threshold. The remaining two steady burning light bars are offset to the left and right of the extended centerline at the 1,000-foot bar. The threshold light array and steady burning light array are collectively referred to as the approach light field. The sequenced flasher array consists of five (5) to eight (8) aviation white flashing light sources. The flasher lights are located at 200-foot intervals, in the direction of the approach and along the extended runway centerline, starting at 200 feet beyond the last steady burning light bar. The collective flashing of all lights in the sequenced flasher array gives the appearance of a ball of light traveling toward the runway. See FIGURE 1 for an overview layout of the entire MALSR light field.

Frangible couplings, Electrical Metallic Tubing (EMT), and Low Impact Resistant (LIR) structures are used to support all MALSR lights. The MALSR system includes a control cabinet that provides electrical power and control signal distribution for the MALSR light field elements. It provides a main power switch for the entire MALSR system, as well as separate power controls for the threshold/steady burning and sequenced flasher light arrays.

The control cabinet also provides a manual and remote control interface for the light field. In either mode, the MALSR light field is capable of operating at three intensity levels. The MALSR system shall be comprised of the main components and associated quantities listed in TABLE I.

**TABLE I. Quantities of Main MALSR Components**

<b>Component</b>	<b>Possible Quantities</b>	<b>Typical Configuration</b>
Threshold Lights	8 to 33	18
Steady Burning Lights	45	45
Sequenced Flasher Lights	5 to 8	5
Control Cabinet	1	1
Supplemental Enclosures	5 to 8	5



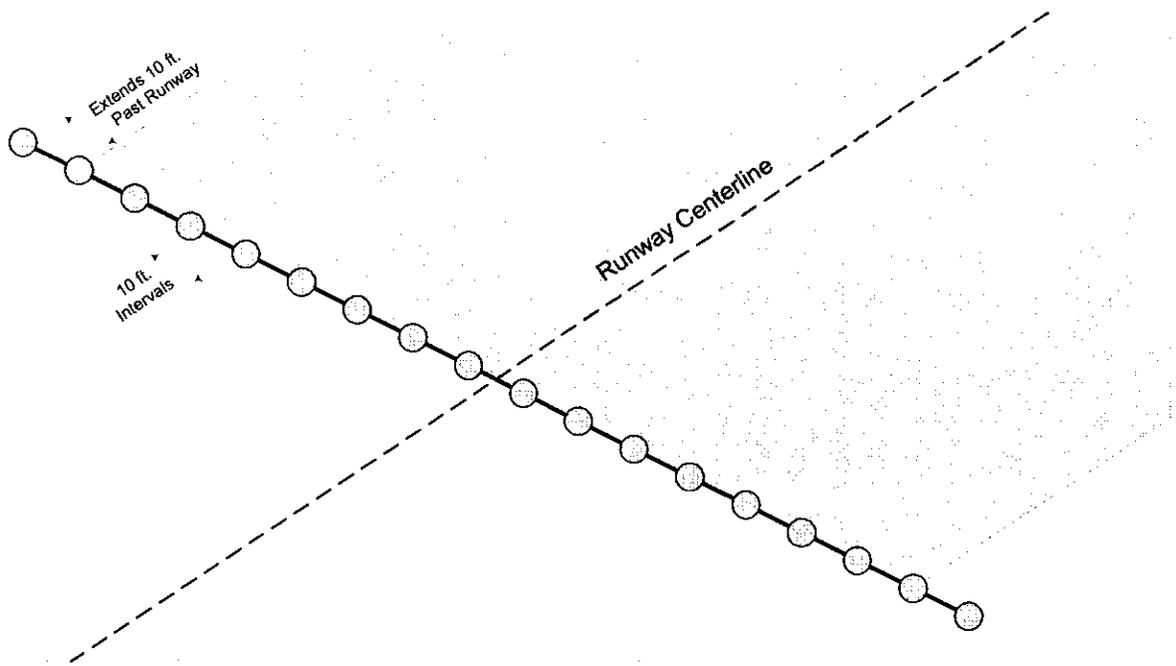
**FIGURE 1. Typical MALSR Light Field Configuration**

### **3.1.1 Threshold Light Source**

The threshold light array will be installed IAW FAA Order 6850.2A at the boundary between the light field and the runway as shown in FIGURE 2. The threshold light array will consist of a row of between 8 and 33 lights evenly spaced at 10-foot intervals, extending 10 feet beyond each side of the runway. The entire threshold light array will form a straight line of steady burning lights perpendicular to the centerline of the runway. The number of threshold light sources will be determined by the width of the runway at the installation site (for a 150-foot wide runway, 18 lights are needed). The threshold light array will be site configured for either elevated threshold lighting (see 3.1.1.2) or semi-flush threshold lighting (see 3.1.1.1).

#### **3.1.1.1 Semi-Flush Threshold Lighting**

The MALSR system shall interface with semi-flush threshold lights as specified in FAA-E-2968.



**FIGURE 2. Threshold Light Array Overview**

**3.1.1.2 Elevated Threshold Lighting**

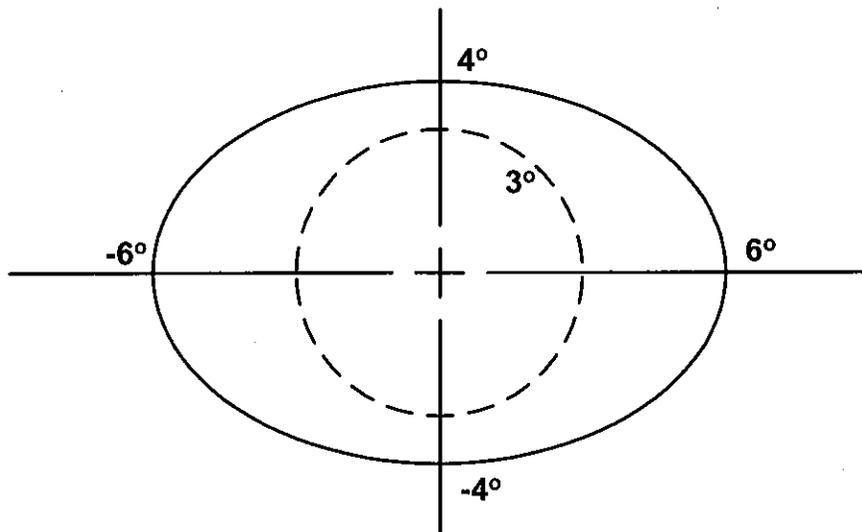
The threshold light source shall meet all the following requirements over the environmental operating conditions specified in 3.4.1.

**3.1.1.2.1 Elevated Threshold Light Beam Characteristics**

The threshold light beam shall exhibit an elliptical pattern defined by the standard ellipse equation:

$$\frac{X^2}{a^2} + \frac{Y^2}{b^2} = 1$$

where X is the horizontal axis and Y is the vertical axis. The outer bounds of the threshold beam (shown in FIGURE 3) shall be no closer than  $\pm 6^\circ$  from the light unit centerline along the horizontal axis ( $a = 6^\circ$ ) and shall be no closer than  $\pm 4^\circ$  from the light unit centerline along the vertical axis ( $b = 4^\circ$ ).



**FIGURE 3. Threshold Light Beam Pattern**

**3.1.1.2.2 Elevated Threshold Light Intensity**

The aviation green output of the threshold lights shall produce three intensity steps that are selected at the control input. Within the threshold beam pattern described in 3.1.1.2.1, and in FIGURE 3, the average intensity (see 4.4.14.1.3) shall be within the required levels for each intensity step as stated in TABLE II.

**TABLE II. Required Levels of Threshold Light Average Intensity**

Threshold Light Average Intensity (Candela)					
Low (4%)		Medium (20%)		High (100%)	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
160	240	800	1,200	4,000	6,000

**3.1.1.2.3 Elevated Threshold Light Intensity Extremes**

Within the threshold beam pattern described in 3.1.1.2.1, and in FIGURE 3, no measured intensity shall be less than the minimum allowable intensity listed in TABLE III for each intensity step. Also, within the threshold beam pattern, the maximum measured intensity shall be no greater than the maximum allowable intensity listed in TABLE III for each intensity step. The maximum measured threshold light intensity shall reside within  $\pm 3^\circ$  in all directions from the light unit centerline (see FIGURE 3).

**TABLE III. Intensity Extremes within Threshold Light Beam**

Threshold Light Intensity Extremes (Candela)					
Low (4%)		Medium (20%)		High (100%)	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
80	360	400	1,800	2,000	9,000

#### **3.1.1.2.4 Elevated Threshold Light Chromaticity**

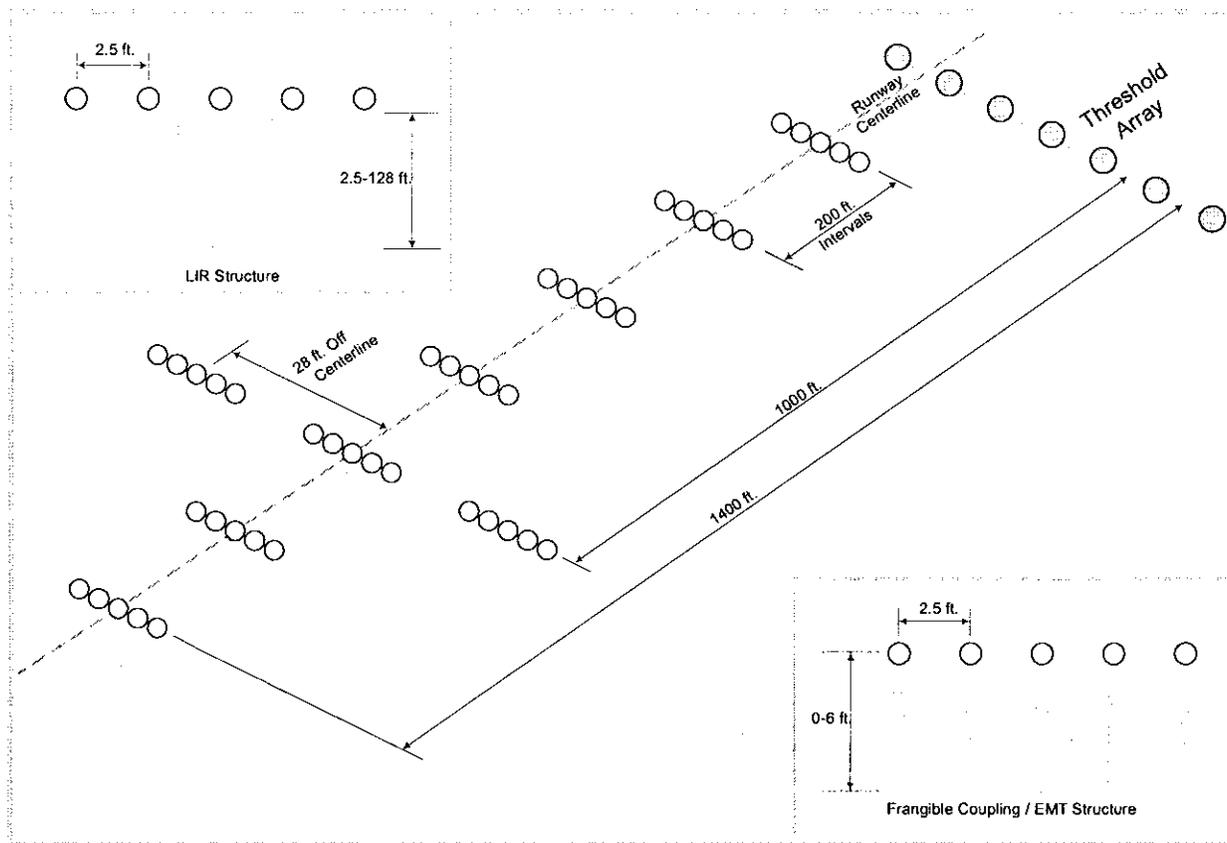
The color of the light emitted from the MALS threshold lights shall be Aviation Green as specified in SAE-AS25050.

#### **3.1.1.2.5 Elevated Threshold Light Source Electrical Interface**

The threshold light array shall provide an electrical interface to the MALS control cabinet. The threshold light array electrical interface shall consist of all power and control signals necessary to operate the threshold light array in the modes described in 3.1.4.1 at a maximum distance of 3,000 feet from the control cabinet. The threshold light source Line Replaceable Unit (LRU) shall have a plug or socket mechanism for maintenance and disconnection of any threshold light. The plug or socket mechanism shall be accessible for maintenance in accordance with (IAW) 3.7. The remaining threshold lights in the array shall operate when any one (1) or more threshold light source LRUs are disconnected or failed.

#### **3.1.2 Steady Burning Light Source**

The steady burning light array will be installed IAW FAA Order 6850.2A and as shown in FIGURE 4. The steady burning light array will consist of seven (7) rows containing nine (9) light bars. Each steady burning light bar will consist of a row of five (5) lights, for a total of 45 lights in the array. The steady burning lights will be spaced 2.5 feet apart on each light bar for a total width of 10 feet (see D-6292-9 and D-6292-13). The first steady burning light bar, located closest to the runway threshold, will be 200 feet from the threshold light array on the extended runway centerline. The orientation of the first steady burning light bar in relation to the threshold array is depicted in D-6292-8. Each successive steady burning light bar station will be 200 feet from the previous station and along the extended runway centerline. The fifth station, located 1000 feet from the runway threshold, will consist of three (3) steady burning light bars installed side-by-side and parallel to the runway threshold, with 28 feet apart (center to center). The 1,000 foot bars will operate identically to the rest of the steady burning lights. The steady burning light array will be site-configured for either, or in combination of, elevated steady burning lighting (see 3.1.2.2) and semi-flush steady burning lighting (see 3.1.2.1).



**FIGURE 4. Steady Burning Light Array Overview**

**3.1.2.1 Semi-Flush Steady Burning Lighting**

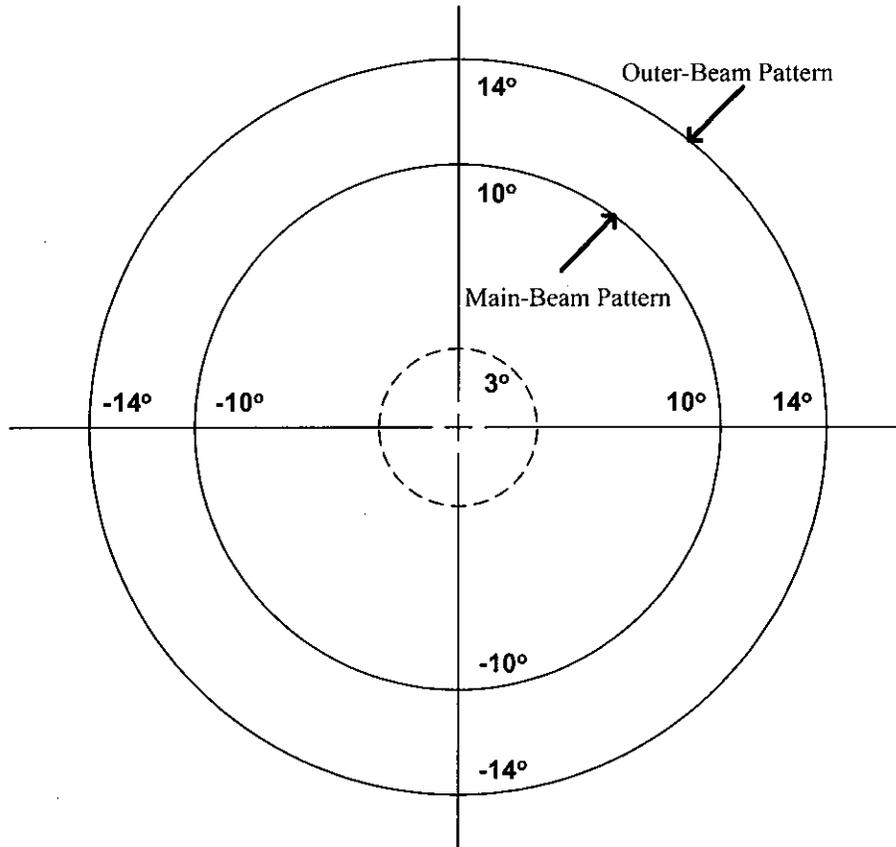
The MALSR system shall interface with semi-flush steady burning lights as specified in FAA-E-2968.

**3.1.2.2 Elevated Steady Burning Lights**

The steady burning lights shall meet all the following requirements over the environmental operating conditions specified in 3.4.1.

**3.1.2.2.1 Elevated Steady Burning Light Beam Characteristics**

The steady burning light beam pattern shall be circular in shape (shown in FIGURE 5). The outer bounds of the steady burning main-beam pattern shall be no closer than  $\pm 10^\circ$ . The steady burning outer-beam pattern, which has lower intensity requirements, shall be no closer than  $\pm 14^\circ$ .



**FIGURE 5. Steady Burning Beam Pattern**

**3.1.2.2.2 Elevated Steady Burning Light Main Beam Average Intensity**

The aviation white output of the steady burning light sources shall produce three intensity steps that are selected at the control input. Within the steady burning main beam pattern described in 3.1.2.2.1, the average intensity (see 4.4.14.2.2) shall be within the required levels as stated in TABLE IV.

**TABLE IV. Required Levels of Steady Burning Light Average Intensity**

<b>STEADY BURNING MAIN BEAM AVERAGE INTENSITY (CANDELA)</b>					
<b>Low (4%)</b>		<b>Medium (20%)</b>		<b>High (100%)</b>	
<b>Minimum</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Maximum</b>
320	480	1,600	2,400	8,000	12,000

#### **3.1.2.2.3 Elevated Steady Burning Light Intensity Extremes**

The maximum measured intensity for the main beam of the steady burning light source on high intensity shall be less than 18,000 candela and reside within  $\pm 3^\circ$  from the light unit centerline (see FIGURE 5). The maximum measured intensity for the outer beam of the steady burning light source on high intensity shall be less than 9,000 candela (see FIGURE 5).

#### **3.1.2.2.4 Elevated Steady Burning Light Chromaticity**

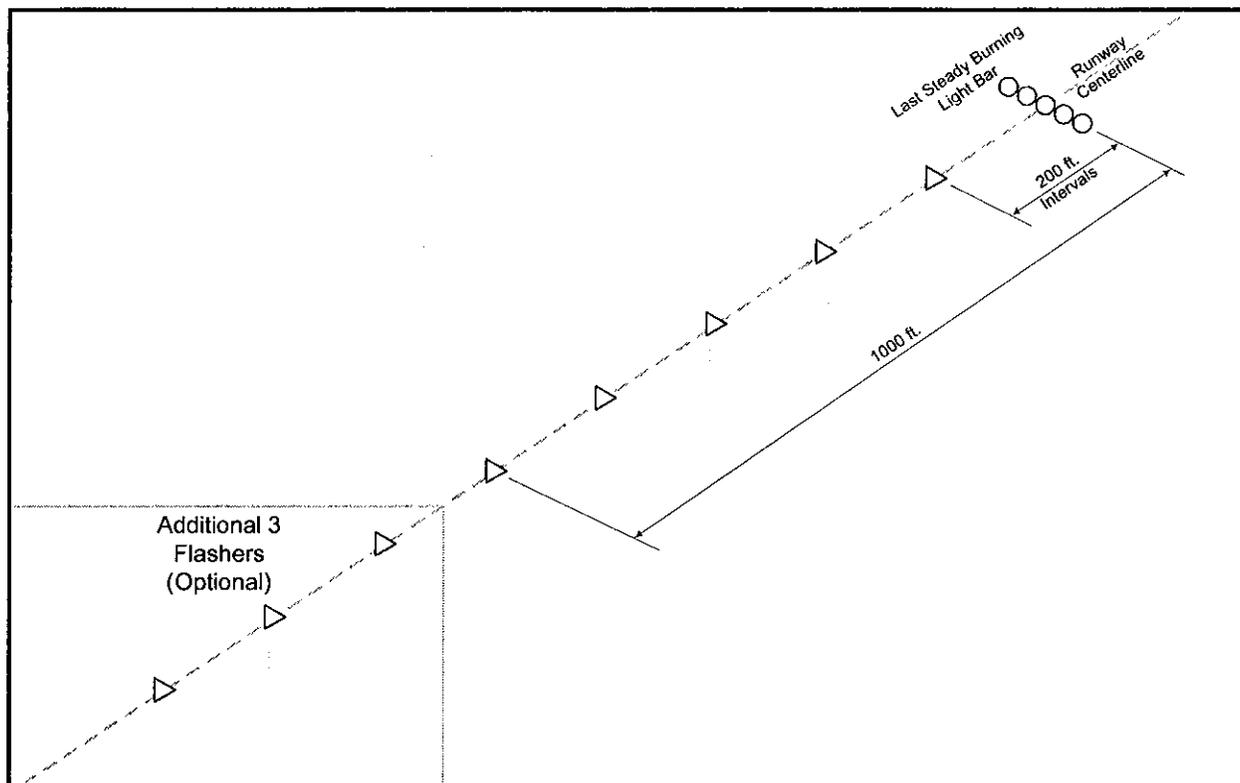
The color of the light emitted from the MALSR steady burning lights shall be Aviation White as specified in SAE-AS25050.

#### **3.1.2.2.5 Elevated Steady Burning Light Source Electrical Interface**

The steady burning light array shall provide an electrical interface to the MALSR control cabinet. The electrical interface shall consist of all power and control signals necessary to operate the steady burning light array in the modes described in 3.1.4.1 to a maximum distance of 3,000 feet from the control cabinet. The steady burning light source LRU shall have a plug or socket mechanism for maintenance and disconnection of any steady burning light. The plug or socket mechanism shall be accessible for maintenance IAW 3.7. The remaining steady burning lights in the array shall operate when any one or more steady burning light source LRUs are disconnected or failed.

### **3.1.3 Sequenced Flasher Array**

The sequenced flashers shall be an array of five (5) to eight (8) flashing lights installed IAW FAA Order 6850.2A and as shown in FIGURE 6. The sequenced flasher units will be installed at regular 200-foot intervals along the extended runway centerline beginning at 1,600 feet from the runway threshold. The flashing lights comprising sequenced flasher array shall flash sequentially, beginning with the sequenced flasher furthest from the threshold, towards the runway threshold at a rate twice per second. The sequenced flasher array shall have the ability to be turned off separately from the rest of the MALSR system. The sequenced flasher array will be site-configured for either, or in combination of, elevated sequenced flashers (see 3.1.3.2) or semi-flush sequenced flashers (see 3.1.3.1).



**FIGURE 6. Sequenced Flasher Array Overview**

**3.1.3.1 Semi-Flush Sequenced Flashers**

The MALSR system shall interface with semi-flush sequenced flashing lights (Type II) as specified in FAA-E-2628.

**3.1.3.2 Elevated Sequenced Flashers**

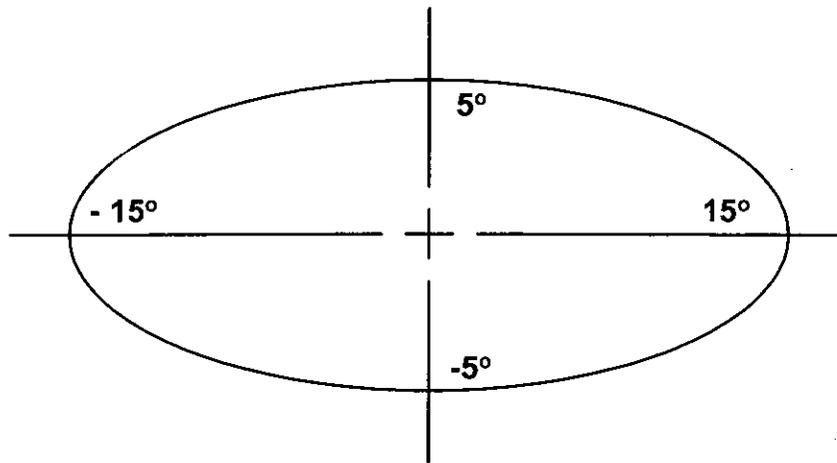
The sequenced flasher lights shall meet the following requirements over the environmental operating conditions specified in 3.4.1.

**3.1.3.2.1 Elevated Sequenced Flasher Beam Characteristics**

The sequenced flasher beam shall exhibit an elliptical pattern defined by the standard ellipse equation:

$$\frac{X^2}{a^2} + \frac{Y^2}{b^2} = 1$$

where X is the horizontal axis and Y is the vertical axis. The outer bounds of the sequenced flasher beam (see FIGURE 7) shall be no closer than  $\pm 15^\circ$  from the light unit centerline along the horizontal axis ( $a = 15^\circ$ ) and shall be no closer than  $\pm 5^\circ$  from the light unit centerline along the vertical axis ( $b = 5^\circ$ ).



**FIGURE 7. Sequenced Flasher Beam Pattern**

**3.1.3.2.2 Elevated Sequenced Flasher Average Effective Intensity**

The sequenced flashers shall produce three (3) intensity steps that are selected at the control input. The average effective intensity (see 4.4.14.3.3) for the sequence flasher at each intensity step shall be within the ranges shown in TABLE V.

**TABLE V. Required Levels of Sequenced Flasher Average Effective Intensity**

<b>Sequenced Flasher Average Effective Intensity (Candela)</b>					
Low		Medium		High	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
150	450	800	2,000	8,000	20,000

**3.1.3.2.3 Elevated Sequenced Flasher Effective Intensity Extremes**

Within the sequenced flasher beam pattern described in 3.1.3.2.1, no measured effective intensity shall be greater than the maximum or less than the minimum extremes described in TABLE V for each intensity step.

**3.1.3.2.4 Elevated Sequenced Flasher Chromaticity**

The color of the light emitted from the MALSRS sequenced flasher lights shall be Aviation White as specified in SAE-AS25050.

**3.1.3.2.5 Elevated Sequenced Flasher Light Source Electrical Interface**

The sequenced flasher array shall provide an electrical interface to the MALSRS control cabinet. The electrical interface shall consist of all power and control signals necessary to operate the sequenced flasher array in the modes described in 3.1.4.1 to a maximum distance of 3,000 feet from the control cabinet. The sequenced flasher light source LRU shall have a plug or socket mechanism for maintenance and disconnection of any sequenced flasher light. The plug or socket mechanism shall be accessible for maintenance IAW 3.7. The remaining sequenced flasher lights in the array shall operate when any one or more sequenced flasher light LRUs are disconnected or failed.

### **3.1.4 Control Cabinet**

The MALSR control cabinet shall include the electrical, mechanical, and electronic components that provide control signals and power distribution to the light field. The control cabinet shall provide the circuitry and controls required to fully operate the MALSR system. MALSR controls shall provide the capability to perform the following:

1. Actuate the entire light field,
2. Switch between the three intensity levels for the threshold, steady burning, and flasher lights,
3. Turn OFF the flashers without disrupting the operation of the threshold and steady burning lights,
4. Trigger the sequencing of the flasher lights,
5. Turn OFF all lights in the MALSR system, and
6. Operate through remote control.

#### **3.1.4.1 System Control**

The MALSR control cabinet shall allow both local (manual) and remote operational control of the light field and light intensity levels.

##### **3.1.4.1.1 Local (Manual) Control**

The MALSR system shall provide two (2) switches in the control cabinet to perform the following local system control functions:

1. Sequenced Flasher ON/OFF,
2. Light Field Mode Control.

The light field mode control switch and the sequenced flasher ON/OFF switch shall be rated for tungsten lamp electrical loads.

##### **3.1.4.1.1.1 Sequenced Flasher ON/OFF Control Switch**

A single throw switch shall be used to enable/disable the sequenced flasher array. The sequence flasher ON/OFF control switch shall not allow both positions to be selected simultaneously. The position of the sequence flasher ON/OFF control switch shall have no effect on the operation of the rest of the MALSR light field (threshold and steady burning light arrays). Each functional position of the sequenced flasher ON/OFF control switch shall be identified by a selection indicator.

**3.1.4.1.1.2 Light Field Mode Control Switch**

Each functional position of the light field mode control switch shall be identified by a selection indicator. The switch shall provide the following functions:

1. System OFF (Local Control),
2. LOW Intensity (Local Control),
3. MEDIUM Intensity (Local Control),
4. HIGH Intensity (Local Control),
5. REMOTE control.

The light field mode control switch shall not allow multiple positions to be selected simultaneously.

**3.1.4.1.2 Remote Control**

When the light field mode control switch (see 3.1.4.1.1.2) is set to the “REMOTE” position, the MALSR system shall be externally controlled as described in 3.1.4.8.

**3.1.4.1.3 Light Field Intensity Steps**

When operational, all lights in the MALSR system (threshold, steady burning, and sequenced flasher) shall function on one of three intensity settings: Low, Medium, or High. Regardless of control method, the entire MALSR light field shall be set to the same intensity level based on the intensity setting. Changing the intensity step to a different setting shall change the intensity of all lights in the MALSR light field. All intensity step changes (including to/from off conditions) shall be completed within two (2) seconds of the applied control signal.

**3.1.4.1.4 Light Field Control Matrix**

The control switches described in 3.1.4.1.1.1 and 3.1.4.1.1.2 shall produce the MALSR light field functionality as described in TABLE VI.

**TABLE VI. MALSR Light Field Control Matrix**

MALSR Control SWITCH Setting	Light Field Intensity Operation		
	Threshold & Steady Burning Light Array Intensity	Sequenced Flasher Light Array Intensity	
		Flasher Switch “ON”	Flasher Switch “OFF”
OFF	OFF	OFF	OFF
LOW	LOW	OFF	OFF
MEDIUM	MEDIUM	OFF	OFF
HIGH	HIGH	OFF	OFF
REMOTE	REMOTELY CONTROLLED (see TABLE IX)		OFF

**3.1.4.1.5 Allowable Switching Sequence**

The control switches described in 3.1.4.1.1.1 and 3.1.4.1.1.2 shall produce the MALSR intensity level switching sequence and minimum dwell time as described in TABLE VII.

**TABLE VII. MALSR Switching Sequence**

Intensity	Off	Low	Medium	High
Switching Sequence	FROM →	→ To →	→ To →	→ To
	To ←	← FROM →	→ To →	→ To
	To ←	← To ←	← FROM →	→ To
	To ←	← To ←	← To ←	← FROM
Dwell Time	Not Applicable	> 250 ms	> 250 ms	Not Applicable

**3.1.4.2 Facility Power**

Power for all subsystems within the MALSR, including the light field, shall be derived from the facility power source specified below.

**3.1.4.2.1 Facility Power – Demand**

The MALSR system power demand, with the sequenced flashers on and the system on high intensity, shall be less than 14 kilowatts (kW) with an objective of 2.8 kW.

**3.1.4.2.2 Facility Power - Voltage**

The facility power interface for the MALSR system shall be four wire, 120/240 volts, 60 Hertz (Hz), single phase, alternating current, consisting of L1, L2, Neutral, and equipment grounding conductor. The MALSR system shall not experience performance degradations with input power voltage variations as specified in FAA-G-2100g.

**3.1.4.2.3 Facility Power - Frequency**

The MALSR system shall not be damaged or experience performance degradations with steady state and momentary deviations in input power frequency as specified in FAA-G-2100g.

**3.1.4.2.4 Facility Power - Phase**

Load balancing shall meet the electrical load balance requirements specified in FAA-G-2100g.

**3.1.4.2.5 Facility Power - Inrush Current**

The MALSR system shall limit the maximum surge current to less than four (4) times the full load operating current. The addition of line reactors or increased transformer leakage inductance within the MALSR system shall have no effect on the overall efficiency, nor result in a system output impedance exceeding two (2) percent of the system load IAW NEPA #70.

**3.1.4.2.6 Facility Power - Harmonics**

The MALSR system harmonics shall meet the input power harmonic requirements specified in FAA-G-2100g. The MALSR system shall not experience performance degradations caused by input power harmonic distortions as specified in FAA-G-2100g.

**3.1.4.2.7 Facility Power Factor**

The MALSR system power factor shall meet the power factor requirements as specified in FAA-G-2100g.

### **3.1.4.3 Input Power Interface**

The MALSR control cabinet shall contain the circuit termination point for the input power interface from a distribution panel. A sub-panel within the control cabinet shall be used to house the power termination point, the main disconnect circuit breaker, subsystem disconnect circuit breakers, neutral bus, grounding bus, and all MALSR power distribution fuses. The MALSR control cabinet shall provide a power distribution system to the threshold, steady burning, and sequenced flasher arrays in the configuration outlined in the MALSR installation drawings D-6292-3.

#### **3.1.4.3.1 Disconnect Circuit Breaker**

The disconnect circuit breakers shall be selected IAW NFPA 70 and FAA-G-2100g. The disconnect circuit breakers shall meet the circuit overload protection requirements as specified in FAA-G-2100g. The disconnect circuit breakers shall be sufficient to operate the MALSR subsystems in all normal operating modes. Solid-state switches shall not be used as disconnect circuit breaker.

##### **3.1.4.3.1.1 Main Disconnect Circuit Breaker**

A main power disconnect circuit breaker shall be used to control the application of power within the MALSR system. The MALSR system shall have a main disconnect circuit breaker that provides circuit protection and power disconnect capabilities for the entire system, except as noted in 3.2.5 and 3.2.6.

##### **3.1.4.3.1.2 Subsystem Disconnect Circuit Breakers**

Subsystem disconnect circuit breakers shall be provided to control the application of power and provide protection to the threshold light array, the steady burning light array, the sequenced flasher light array, the remote control terminal block, the threshold and steady burning light control circuitry, and the sequence flasher control circuitry. When the MALSR system is de-energized through the main power disconnect breaker, regardless of operating mode (local or remote), the input side of all subsystem disconnect circuit breakers shall be open circuited.

#### **3.1.4.3.2 Power Interface Protection**

Protected power interfaces include the facility power interface, control cabinet, and each light array (threshold, steady burning, and sequenced flashers) power interfaces as defined in 3.1.4.1.5 through 3.1.4.7.

##### **3.1.4.3.2.1 Conducted Power Line Surges**

Power interfaces within the MALSR system shall be protected from any conducted power line surges as specified in FAA-STD-019d.

##### **3.1.4.3.2.2 Power Transients**

The power interfaces within the MALSR system shall provide conducted line transient protection as specified in FAA-STD-019d. The system shall be operational when exposed to a combination waveform consisting of a 1.2/50 microsecond ( $\mu$ s) voltage spike at 10 kilovolts (kV) and an 8/20 $\mu$ s current spike at 10 kiloamps (kA).

##### **3.1.4.3.2.3 Under and Over-Voltage Conditions**

The MALSR system performance shall not be damaged by facility power input voltage conditions outside those specified in 3.1.4.2.2. The 120/240 volts (V) circuits within the MALSR system shall maintain normal operation during voltage/time events as defined by the “FAA Input Power Tolerance Envelope” presented in Appendix 1 of FAA-G-2100g.

#### **3.1.4.3.2.4 Power Outages**

The MALSR system performance shall not be damaged by facility power outage conditions. When facility power is restored following an outage, the MALSR system, when in local control as outlined in 3.1.4.1.1, shall return to the same state of service as before the power outage.

#### **3.1.4.4 Signal Interface**

The MALSR system shall not be damaged by any interface disturbance at any of the following internal and external interfaces within the MALSR system unless otherwise indicated: remote control terminal block, threshold light array, steady burning light array, and sequenced flasher array interfaces.

##### **3.1.4.4.1 Signal Transients**

The MALSR signal interfaces shall provide conducted line transient protection as specified in FAA-STD-019d.

#### **3.1.4.5 Interface to Threshold Light Source**

The MALSR control cabinet shall provide power necessary to operate the threshold light array as described in 3.1.4.3.2 and 3.1.4.1.5. The MALSR control cabinet shall provide control signals necessary to operate the threshold light array in the manual and remote modes as described in 3.1.4.1.1 and 3.1.4.8.5.

#### **3.1.4.6 Interface to Steady Burning Light Sources**

The MALSR control cabinet shall provide power necessary to operate the steady burning array as described in 3.1.4.3.2 and 3.1.4.1.5. The MALSR control cabinet shall provide control signals necessary to operate the steady burning light array in the manual and remote modes described in 3.1.4.1.1 and 3.1.4.8.5.

#### **3.1.4.7 Interface to Sequenced Flasher Light Sources**

The MALSR control cabinet shall provide power necessary to operate the sequenced flasher array as described in 3.1.4.3.2 and 3.1.4.1.5. The MALSR control cabinet shall provide control signals necessary to operate the sequenced flasher light array in the manual and remote modes described in 3.1.4.1.1 and 3.1.4.8.5.

#### **3.1.4.8 Remote Control Interface**

##### **3.1.4.8.1 Remote Control Terminal Block**

Termination of the remote control signal lines shall be provided in a remote control terminal block. The remote control terminal block shall meet the requirements in 3.2.3.

### 3.1.4.8.2 Remote Control Signal Lines

The remote control terminal block shall provide an interface for eight (8) signals as described in TABLE VIII. When the light field mode control switch is in the REMOTE control position, the MALSR shall be controlled through the signals received through the Remote Control Terminal Block.

**TABLE VIII. Remote Control Terminals and Signals**

<b>Terminal</b>	<b>Signal Description</b>
1	120 VAC Voltage Output
2	Spare (not used)
3	MALSR Light Field - LOW Intensity Setting (120 VAC Input)
4	MALSR Light Field - MEDIUM Intensity Setting (120 VAC Input)
5	MALSR Light Field - HIGH Intensity Setting (120 VAC Input)
6	Spare (not used)
7	Flasher Lights ON Control (120 VAC Input)
8	120 VAC Neutral

### 3.1.4.8.3 Remote Control Signal Lines Current Loading

The maximum MALSR current loading for any single remote control input terminal (3, 4, 5, 7) shall be 500 milliamps (mA).

### 3.1.4.8.4 Remote Control Signal Line Terminals

When individually or when any combination of terminals 3, 4, 5, 7 are set to 120 VAC, when referenced to ground, the terminals shall be considered ON (energized).

#### 3.1.4.8.4.1 Terminal 1

Remote Control Terminal 1 shall be internally connected to 120 VAC power.

#### 3.1.4.8.4.2 Terminal 3 through Terminal 5

When the Terminal 1, 120 VAC signal is present on Terminals 3 through 5 in one of the mapped combinations shown in TABLE IX, it shall be interpreted by the MALSR system as an active or enable condition for the steady burning and threshold lights to operate on that intensity level.

#### 3.1.4.8.4.3 Terminal 7

When the 120 VAC signal is present on Terminal 7 as shown in TABLE IX, it shall be interpreted by the MALSR system as an active or enable condition for the sequenced flashers to operate on the intensity level mapped by Terminals 3 through 5.

#### 3.1.4.8.4.4 Terminal 8

Terminal 8 shall be connected to the neutral bus internal to the MALSR system.

### 3.1.4.8.5 Remote Control Terminal States

The remote control signals described in 3.1.4.8.4 through 3.1.4.8.4.4 shall provide the following MALSR system functionality as described in TABLE IX.

**TABLE IX. Remote Control Terminal State Functionality**

MALSR Intensity Setting		Remote Control Terminal			
Threshold & Steady Burning Light Arrays	Sequenced Flasher Array	3	4	5	7
OFF	OFF	0	0	0	0
LOW	LOW	120 VAC	0	0	120 VAC
LOW	OFF	120 VAC	0	0	0
MEDIUM	MEDIUM	120 VAC	120 VAC	0	120 VAC
MEDIUM	OFF	120 VAC	120VAC	0	0
HIGH	HIGH	120 VAC	120 VAC	120 VAC	120 VAC
HIGH	OFF	120 VAC	120 VAC	120 VAC	0

Note: All combinations not depicted in this table shall be mapped as an OFF setting for the entire MALSR system.

### 3.1.4.9 Sequenced Flasher Control

#### 3.1.4.9.1 Flasher Sequence

The flasher sequence shall consist of eight (8) flasher triggers beginning with the flasher farthest from the runway threshold and proceeding to the flasher closest to the runway threshold. The flasher sequence shall be triggered 120 times a minute regardless of the number of flasher units present. The triggering of any flasher sequence shall coincide with the first flasher trigger. The time between the start of consecutive flash sequences shall be  $0.5 \pm 0.015$  seconds.

#### 3.1.4.9.2 Flasher Triggers

MALSR flasher trigger and timer circuits shall be designed to accommodate a maximum of eight (8) flasher light sources (units). For the five (5) sequenced flasher configuration, trigger number 6, 7, and 8 shall be left unconnected.

#### 3.1.4.9.3 Flash Duration

The flash duration shall be no greater than 5.5 milliseconds (ms) and no less than 0.25 ms.

#### 3.1.4.9.4 Flash Interval

The interval between flashes of adjacent units shall be  $33.3 \pm 0.1$  ms.

#### 3.1.4.9.5 Flasher Unit Failure

The failure of one or more flashers in the array shall have no effect on the operation of the remaining units.

#### 3.1.4.9.6 Untriggered Flasher Unit Fire

A flasher unit shall not fire without a flasher trigger.

#### 3.1.4.9.7 Flasher Misfiring (Flash Skipping)

Flasher unit misfiring shall be less than 1 percent over 60 minutes with no misfires occurring on adjacent flasher units consecutively.

#### **3.1.4.10 System Status / Diagnostic Display**

The MALSR control cabinet shall be capable of displaying a visual indication of all current operational commands received manually (locally), or remotely.

##### **3.1.4.10.1 Current Operating Mode Display**

The System Status / Diagnostic Display shall be capable of displaying the current operating modes to include: System On, System Off, Low Intensity, Medium Intensity, High Intensity, Sequence Flashers On, and Sequence Flashers Off.

##### **3.1.4.10.2 Control Circuitry Diagnostic Display**

The System Status / Diagnostic Display shall be capable of displaying all diagnosed faults within the control cabinet.

##### **3.1.4.10.3 Sequenced Flasher Trigger Control Circuitry Diagnostic Display**

The System Status / Diagnostic Display shall be capable of displaying the flasher sequence rate, individual flasher trigger pulse indicator, and the flash interval.

#### **3.1.5 MALSR Support Equipment**

##### **3.1.5.1 Light Source Aiming Device**

A single alignment device shall be provided to aim threshold, steady burning, and sequenced flashing lights installed in all possible mounting configurations detailed in 3.2.2.6.1, 3.2.2.6.2, and 3.2.2.6.3.

##### **3.1.5.1.1 Aiming Device Accuracy**

The alignment device shall indicate aiming angle on a scale calibrated in at least 1° increments and be accurate to within  $\pm 0.5^\circ$  of the actual angle with the device attached. The alignment device shall provide light source vertical alignment to within  $\pm 1^\circ$  of the desired aiming angle following the removal of the alignment device. The alignment device shall permit field aiming of the light beam at any angle from 0° to +25° above the horizontal.

##### **3.1.5.1.2 Aiming Device Operations**

The alignment device shall allow the operator to aim lights without the need for tools. The alignment device shall not require the disassembly of any part of the light assembly or removal of the light source to complete the aiming activity.

The alignment device shall be capable of aiming threshold and steady burning lights when mounted on LIR structures that conform to FAA-E-2604 or FAA-E-2702. The alignment device shall retain its reading when the tower is lowered. Starting with the structure in the elevated position, the alignment device shall permit aiming from the ground after lowering the structure parallel to the runway centerline a maximum of two (2) times (including installation and removal of the alignment device).

### **3.1.5.1.3 Aiming Device Physical Requirements**

The alignment device shall weigh no greater than two (2) lbs. The alignment device shall be constructed of non-corrosive material. The alignment device shall have no loose parts. Self-retaining fastening devices shall be used to assemble any parts. The alignment device shall provide means to retain an alignment reading when subject to movement or transport. The alignment device may be electronic, mechanical, or a combination of both. If the alignment device is mechanical, it shall have an enclosed dial and stop brake to hold the reading. If the alignment device is electrical, it shall be battery powered.

### **3.1.5.1.4 Aiming Device Environmental Requirements**

The alignment device shall operate in the environmental conditions specified in 3.4.1 with the exception of 3.4.1.10 and 3.4.1.11. The alignment device shall operate in winds of 25 knots gusting to 35 knots.

### **3.1.5.1.5 Aiming Device Storage and Transport**

The alignment device stored in its transport case shall be transportable by one person. The alignment device transport case shall protect the alignment device from damage when subjected to drops from a height of four (4) feet at any angle on any axis.

## **3.1.5.2 Sequenced Flasher Test Unit**

### **3.1.5.2.1 Test Unit Interface**

The MALSR system shall have a sequenced flasher test interface at the supplemental enclosure for each sequenced flasher. The interface shall provide for a sequenced flasher test unit to verify correct operation of the MALSR flasher control parameters as described in 3.1.4.9.

### **3.1.5.2.2 Test Unit Failure Identification**

The interface shall allow for identification of failures and out-of-specification performance of sequenced flasher units and control circuitry to the LRU level. The sequenced flasher test unit shall identify the following:

1. Input voltage and current of the sequenced flasher unit
2. Flash Rate
3. Anode voltage for capacitive discharge xenon flash tubes or the lamp input voltage and current for other light sources.
4. Bleed down time for capacitive discharge xenon flash tubes
5. Interlock switch status

### **3.1.5.2.3 Test Unit Operations**

The sequenced flasher test unit shall provide all measurement functions in two (2) or fewer operator actions. LRU fault isolation shall be accomplished by a single test. The sequenced flasher test unit display shall be visible under all ambient lighting conditions. Linear electrical data and out of tolerance values shall be displayed in engineering units. LRU information shall be displayed in English language formats without the use of special codes or look-up tables. The sequenced flasher test unit shall have the capability to trigger sequenced flasher.

### **3.1.5.2.4 Test Unit Environmental Requirements**

The sequenced flasher test unit shall operate in the environmental conditions specified in Section 3.4 with the exception of 3.4.1.10 and 3.4.1.11. The sequenced flasher test unit shall operate in winds of 25 knots gusting to 35 knots.

### **3.1.5.2.5 Test Unit Storage and Transport**

The sequenced flasher test unit shall be portable. The sequenced flasher test unit transport case shall protect the sequenced flasher test unit from damage when subjected to drops from a height of four (4) feet at any angle on any axis.

## **3.2 Hardware Requirements**

Hardware components selected/designed for use in the MALSR system shall meet the Materials, Processes, and Parts requirements as specified in FAA-G-2100g. No moving parts (i.e., relays, contactors, fans) shall be incorporated in the MALSR system.

### **3.2.1 Cabinets**

#### **3.2.1.1 Control Cabinet**

The MALSR system shall contain a control cabinet.

##### **3.2.1.1.1 Control Cabinet Ground Lug**

The Control Cabinet shall provide an internal ground lug located in the inside bottom edge of the cabinet and electrically connected (not isolated) from the control cabinet. The ground lug shall be compatible with the enclosure type. The ground lug shall accept the gauge of the grounding conductor which shall be of the same gauge of the phase conductors as required for the design of the system based on the NEC and FAA-STD-019d. If multiple grounding conductors are used, the ground lug shall be a multiple conductor type lug.

##### **3.2.1.1.2 Control Cabinet Construction**

The control cabinet shall not bend or distort under normal commercially accepted methods of shipping, handling, storage, and installation.

##### **3.2.1.1.3 Control Cabinet Size**

The control cabinet shall be no greater than 40 inches tall, 29 inches wide, by 16 inches deep.

##### **3.2.1.1.4 Control Cabinet Weight**

The control cabinet shall weight no greater than 85 pounds.

##### **3.2.1.1.5 Control Cabinet Materials**

Materials used for the control cabinet shall meet the material requirements specified in FAA-G-2100g. NEMA 4X type enclosures made of 304 Stainless Steel, as defined in the NEMA 250 standard, shall be used even if the system element is located inside of a shelter. The control cabinet shall operate under the environmental conditions specified in 3.4.1.

##### **3.2.1.1.6 Control Cabinet External Mounting Provisions**

The control cabinet shall provide integral vertical mounting provisions external to the enclosure so that it can be mounted inside a shelter (see D-6292-19) and on an external frame (see D-6292-

5). External mounting studs shall not protrude through the internal surface of the control cabinet wall.

#### **3.2.1.1.7 Control Cabinet Internal Mounting Provisions**

Control cabinet subassemblies shall be mounted on a panel attached to the rear interior cabinet wall using studs. All subassemblies shall be attached to the panel using fasteners as specified in FAA-G-2100g. Slotted mounting holes may be used for attachment of mechanical items. Internal mounting studs shall not protrude through the exterior surface of the control cabinet wall.

#### **3.2.1.1.8 Control Cabinet Door**

The control cabinet door shall be hinged vertically, opening to the right side when the cabinet is mounted in a vertical, upright position. A control cabinet doorstop shall be provided for locking the door in a 120° ( $\pm 15^\circ$ ) open position. Electrical components and cables shall not be attached to the control cabinet door. Continuous gaskets, commensurate with specified environmental operating conditions (see 3.3) and electromagnetic interference (see 3.5), shall be used to seal the control cabinet with the door in the closed position. Grounding of the control cabinet door shall be IAW the hinged panels and doors requirements as specified in FAA-G-2100g.

#### **3.2.1.1.9 Control Cabinet Door Handle**

The control cabinet door handle lever shall include provisions for a security padlock. The padlock holes in the control cabinet door handle shall be aligned to accommodate a six (6) inch long by 3/8-inch diameter horizontal rod when the door handle is in the locked position and the cabinet is oriented in a vertical upright position. The control cabinet door handle shall be within  $\pm 22^\circ$  of vertical when in the locked position. When closed and locked, the control cabinet door shall remain closed and locked regardless of the installed padlock shaft diameter.

#### **3.2.1.1.10 Control Cabinet Power Sub-Panel**

The control cabinet shall contain a sub-panel to house the facility power interface circuitry as specified in 3.1.4.1.5 and local control switches as specified in 3.1.4.1.1. The control cabinet power sub-panel shall be hinged. The MALSR Light Mode Control Switch, Sequenced Flasher ON/OFF Switch, all Circuit Disconnect Breakers, and all fuses shall be accessible when the control cabinet power sub-panel is in the closed position. The control cabinet power sub-panel shall be held closed by a minimum of two (2) captive screws.

#### **3.2.1.1.11 Control Cabinet Component Layout**

The component layout within the control cabinet shall provide clearance for field installation and maintenance. Power and control signal terminal blocks shall be located near cable entry locations. The MALSR control cabinet shall meet accessibility requirements as specified in FAA-G-2100g.

#### **3.2.1.1.12 Control Cabinet Wiring Diagram Attachment**

The inside of the control cabinet door shall facilitate the attachment of a laminated detailed electrical interconnection schematic of the control cabinet.

### **3.2.1.2 Supplemental Enclosures**

The MALSR system may use supplemental enclosures or Individual Control Cabinet (ICC). The quantity of supplemental enclosures shall be no greater than the number of sequenced flasher units.

#### **3.2.1.2.1 Supplemental Enclosure Ground Lug**

Supplemental enclosures shall meet the ground lug requirements specified in 3.2.1.1.1.

#### **3.2.1.2.2 Supplemental Enclosure Construction**

Supplemental enclosures shall meet the cabinet construction requirements in 3.2.1.1.2.

#### **3.2.1.2.3 Supplemental Enclosure Materials**

Supplemental enclosures shall meet the cabinet materials requirements in 3.2.1.1.5.

#### **3.2.1.2.4 Supplemental Enclosure External Mounting Provisions**

Supplemental enclosures shall provide integral vertical mounting provisions external to the enclosure. If the supplemental enclosure is to be used within the runway safety area or runway object free area, mounting provisions shall include two 2-inch threaded fittings on the bottom surface together with mounting lugs located on the rear surface. A third fitting shall be furnished on the bottom surface of the supplemental enclosure to accommodate a 3/4-inch flexible conduit. External mounting studs on the supplemental enclosure shall not protrude through the internal surface of the enclosure wall.

#### **3.2.1.2.5 Supplemental Enclosure Internal Mounting Provisions**

Internal mounting studs on the supplemental enclosure shall not protrude through the external surface of the enclosure wall.

#### **3.2.1.2.6 Supplemental Enclosure Door**

The supplemental enclosure door shall be hinged vertically, opening to the right side when the cabinet is mounted in a vertical, upright position. Electrical components and cables shall not be attached to the supplemental enclosure door. Continuous gaskets, commensurate with specified environmental operating conditions (see 3.3) and electromagnetic interference (see 3.5), shall be used to seal the supplemental enclosure with the door in the closed position. Grounding of a Supplemental Enclosure door shall be IAW the hinged panels and doors requirements as specified in FAA-G-2100g.

#### **3.2.1.2.7 Supplemental Enclosure Component Layout**

Supplemental enclosures shall meet the component layout requirements in 3.2.1.1.11.

#### **3.2.1.2.8 Supplemental Enclosure Wiring Diagram Attachment**

Supplemental enclosures shall meet the wiring diagram attachment requirements in 3.2.1.1.12.

### **3.2.2 Light Source Mechanical Requirements**

Unless otherwise specified, the following light source requirements shall apply to each light assembly in the threshold light array, steady burning light array, and the sequenced flasher array.

**3.2.2.1 General**

The light assembly shall consist of a light source, light holder, and a light-mounting base. Each light assembly shall contain the hardware necessary to mount one (1) light. The light assembly shall be painted Aviation Orange IAW FED-STD-595.

**3.2.2.2 Threshold Light Assembly Weight**

The complete threshold light assembly (light source and hardware) shall weigh no more than 6.5 pounds (lbs).

**3.2.2.3 Steady Burning Light Assembly Weight**

The complete steady burning assembly shall weigh no more than 1.5 lbs when installed on a frangible coupling or EMT conduit.

The complete steady burning assembly shall weigh no greater than 1.0 lb when installed on a LIR structure Tee-Bar.

**3.2.2.4 Sequenced Flasher Light Assembly Weight**

The complete sequenced flasher assembly shall weigh no more than 6.5 lbs.

**3.2.2.5 Light Assembly Vertical Adjustment**

The light assembly shall provide continuous vertical adjustment of the light beam axis from 0° horizontal to 25° above horizontal. The light assembly shall permit vertical alignment of the light beam to any vertical angle within  $\pm 0.5^\circ$ . A locking mechanism shall be provided to securely lock each light assembly in its set position. The light shall operate over the entire vertical alignment range. The light assembly locking mechanism shall keep the light aligned while exposed to the wind and ice loading requirements specified in 3.4.1.10 and 3.4.1.11.

**3.2.2.6 Light Assembly Mounting Base**

The light assembly mounting base shall provide rigid mechanical support for one (1) light source holder. The light assembly mounting base shall have an internal wire-way that provides an interface to all signal and power wires from the bottom of the light mounting base. Three (3) equally spaced (120°) 3/8-inch cup point set or machine screws shall be used to secure the light assembly mounting base to the support structure.

The adaptable light assembly mounting base mechanical solution shall be such that the light mounting base will have a universal interface that can be interchanged between frangible coupling, frangible coupling/EMT, and LIR mounting arrangements.

**3.2.2.6.1 Frangible Coupling Interface**

The light assembly mounting base shall interface with a frangible coupling IAW C-6046. The frangible coupling interface shall consist of "slip fitter," capping the top of the frangible coupling directly with the light assembly mounting base.

**3.2.2.6.2 Electrical Metallic Tubing (EMT) Interface**

The light assembly mounting base shall allow for the elevated mounting of the assembly on a two (2) inch diameter Electrical Metallic Tubing (EMT) conduit. The EMT interface shall consist of "slip fitter," capping the top of the EMT directly with the light assembly mounting base.

#### **3.2.2.6.2.1 EMT Mounting, Threshold Light Assembly**

The threshold light assembly mounting base shall interface with the EMT conduit IAW D-6292-7. The reference to a PAR-56 Lamp Holder in D-6292-7 should be disregarded. Elevated mounting of the threshold light assembly will be achieved by extending the EMT conduit between the frangible coupling and the light assembly mounting base. Elevated mounting of the threshold light assembly will be no greater than 14 inches above the runway.

#### **3.2.2.6.2.2 EMT Mounting, Steady Burning Light Assembly**

The steady burning light assembly mounting base shall interface with the EMT conduit IAW D-6292-9. Elevated mounting of steady burning light assemblies using EMT will be less than six (6) feet vertical from the base of the frangible coupling to the center of the light source. Each steady burning light assembly will be mounted on its own EMT support.

#### **3.2.2.6.2.3 EMT Mounting, Sequenced Flasher Light Assembly**

The sequenced flasher light assembly mounting base shall interface with the EMT conduit IAW D-6292-9. Elevated mounting of sequenced flashers light assembly using EMT will be no greater than six (6) feet vertically from the base of the frangible coupling to the center of the light source.

#### **3.2.2.6.3 Low-Impact Resistance (LIR) Structural Mounting Interface**

The Low-Impact Resistance (LIR) Structural Mounting requirement shall be applied to the steady burning and sequenced flasher light assemblies. The light assembly mounting base shall allow for elevated mounting of the light assembly on an LIR structure. Elevated mounting of light assemblies using LIR structures will be between 6 feet and 128 feet from the ground elevation of the LIR structure to the center of the light source.

##### **3.2.2.6.3.1 LIR Mounting, Steady Burning Light Assembly**

The steady burning light assembly mounting base in a given light bar shall interface with the LIR by connecting to the T-M Tee-Bar structure IAW D-6292-13, D-6292-14, and D-6155-2.

##### **3.2.2.6.3.2 LIR Mounting, Sequenced Flasher Light Assembly**

The sequenced flasher light assembly mounting base shall interface with the LIR by fitting into the LIR tube cap T-1 assembly as specified in D-6292-13 and D-6213-15.

#### **3.2.3 Terminal Blocks**

All MALSR power and signal interfaces shall terminate at terminal blocks. Terminal blocks shall be the enclosed base type terminal blocks using pressure plate type terminal connectors. Terminal blocks shall have ten (10) percent unused terminals, but not less than two (2) extra terminals per terminal block. Power terminal blocks shall have a minimum of six (6) inches clear space at the input and output terminals. Control terminal blocks shall have a minimum of four (4) inches clear space at the input and output terminals. Solid and stranded wires shall not

be co-located in the same terminal. Different wire gauges shall not be co-located in the same terminal.

### **3.2.3.1 Terminal Block Cover**

All terminal blocks shall have a polycarbonate, acrylic or similar transparent, non-conductive material protective covers. The protective cover shall have meter probe access holes for all terminals to aid in maintenance.

### **3.2.4 Elapsed Time Meters**

An elapsed time meter shall be installed in the control cabinet to indicate the number of hours of operation. The elapsed time meter shall not be re-settable. The elapsed time meter shall allow the counter to recycle back to zero once the system has exceeded the maximum measured elapsed time. The elapsed time meter shall accumulate elapsed time in hours and tenths of hours over the range of 0 to 99,999.9 hours. The accumulated time in the elapsed time meter shall be retained regardless of system power status.

### **3.2.5 Maintenance Light**

The MALSR control cabinet shall contain a locally actuated 120 VAC, Standard Edison Light Bulb Socket. The maintenance light shall function even when the MALSR main disconnect circuit breaker is off.

Supplemental enclosures shall contain a locally actuated 120 VAC, Standard Edison Light Bulb Socket. The supplemental enclosure maintenance light shall be connected to the power provided from the applicable power interface from the MALSR control cabinet.

The maintenance light shall be sufficient to illuminate the entire control cabinet or supplemental enclosure for maintenance purposes. The maintenance light shall be protected from damage due to inadvertent impact with standard maintenance tools. The maintenance light shall be protected with either a dedicated fuse housed and activated with a dedicated on/off switch or a single pole circuit breaker. A fuse, if used, shall meet the fuse, fuse-holder, and associated hardware requirements as specified in FAA-G-2100g. A circuit breaker, if used, shall meet the circuit breakers requirements as specified in FAA-G-2100g.

### **3.2.6 Convenience Receptacles**

The control cabinet shall contain a 120 VAC duplex convenience receptacle. The receptacle in the control cabinet shall function even when the MALSR main disconnect circuit breaker is off.

Supplemental enclosures shall contain a 120 VAC duplex convenience receptacle. The receptacle in the supplemental enclosure shall be connected to the power provided from the applicable power interface within the MALSR control cabinet.

The receptacle shall be Nationally Recognized Testing Laboratory (NRTL) listed UL943-93 Ground Fault Circuit Interrupter (GFCI) type electrical outlet, rated for 15 amps minimum, and containing a manual set and reset function. The duplex convenience receptacle shall be protected with a dedicated 15-amp fuse housed in an illuminated base. The duplex convenience receptacle shall meet the convenience outlet requirements as specified in FAA-G-2100g. The

receptacle shall be located in an unobstructed area within the control cabinet or supplemental enclosure.

### **3.3 Electrical Requirements**

Unless otherwise specified, all power circuitry, cabling, wiring, and enclosures shall be approved by NRTL and meet NFPA 70 requirements.

#### **3.3.1 Solid-State (Microprocessor) Switches**

The MALSR system shall use solid-state switches for all control and electrical switching components with the exception of circuit breakers. MALSR switching control shall be accomplished using microprocessors. Programmable elements shall not be remotely accessible.

##### **3.3.1.1 Solid-State (Microprocessor) Power Interruption**

The solid state switching devices shall remain active for at least 100 ms following a power interruption to avoid inadvertent system outages. The solid state switching devices shall automatically reset on power up, or in the event of power interruption exceeding 100 ms.

#### **3.3.2 High Voltage Component Requirements**

All material used in the construction and assembly of components and circuits operating above 6,000 volts, including the insulation of wires that are to be located near or in the sequenced flasher lamp chamber, shall be ozone resistant.

#### **3.3.3 Dielectric Cable Insulation**

MALSR cables used in high voltage circuits shall have no more than 1 mA of leakage current when subjected to twice normal circuit voltage plus 1,000 volts at the circuit frequency for one (1) minute.

#### **3.3.4 Grounding, Bonding, and Shielding**

All grounding shall be IAW the National Electric Code and as outlined in FAA-STD-019d Paragraphs 3.12 and 3.13. All bonding shall be IAW FAA-STD-019d Paragraph 3.14. All shielding shall be IAW FAA-STD-019d Paragraph 3.15.

#### **3.3.5 Wiring and Marking**

Equipment nameplates and marking shall be IAW FAA-G-2100g. System wiring and marking shall be IAW FAA-G-2100g. Wiring markings and conductor identification shall be IAW NFPA No. 70, Articles 310.11 and 310.12.

#### **3.3.6 Lightning Protection**

The MALSR system lightning protection shall be IAW the lightning protection system requirements as specified in FAA-STD-019d.

#### **3.3.7 Internal Signal and Power Cables**

MALSR system cables (power and signal), external to the facility, shall be selected based on the requirements specified in NFPA No. 70, Article 310.

### **3.4 Environmental Requirements**

#### **3.4.1 Operational Environmental Requirements**

All equipment used in the MALS SR system shall be designed for outdoor installation. The MALS SR system shall operate continuously or intermittently under the environmental conditions specified below. The system shall be capable of performing satisfactorily under the Common Outdoor Operating Environmental Conditions as specified in FAA-G-2100g except where the requirements in the following subsections differ.

##### **3.4.1.1 Temperature**

The system shall exhibit no adverse effects during operation at temperature ranges at all specified climate categories in Table C-1 of MIL-STD-810F.

##### **3.4.1.2 Humidity**

The system shall exhibit no adverse effects during operation at relative humidity levels over all climate categories defined in Table C-1 of MIL-STD-810F.

##### **3.4.1.3 Altitude**

The system shall exhibit no adverse effects during operations at an altitude range from -300 feet to 10,000 feet as specified in FAA-G-2100g.

##### **3.4.1.4 Sand and Dust**

The system shall exhibit no adverse effects during exposure to wind blown sand and dust particles of 5,700 feet/minute (ft/min) and 1,750 ft/min respectively.

##### **3.4.1.5 Salt Spray**

The system shall operate under exposure to salt-laden atmosphere with relative humidity as stated in 3.4.1.2.

##### **3.4.1.6 Rain**

The system shall operate under exposure to wind blown rain at rain rates up to 4 inches/hour (in/h) (10 centimeters/hour (cm/h)) and wind velocities up to 40 miles/hr (mph).

##### **3.4.1.7 Thermal Shock**

The system shall withstand exposure of external surfaces (including the light windows) to sudden application of cold [0° C to 5° C (32° F to 41° F)] water when the lights reach stable temperatures in the high intensity mode.

##### **3.4.1.8 Solar Radiation (Sunshine)**

The system shall operate under exposure to sunshine as specified for all climate categories as defined in Table C-1 of MIL-STD-810F.

##### **3.4.1.9 Vibration**

Any MALS SR component intended to be used in the light plane shall be capable of withstanding vibrations as defined by Procedure 514.5, Figure C-14 in MIL-STD-810F using the parameters presented in TABLE X.

**TABLE X. Vibration Profile Parameters**

Parameter	Value
$W_1$	0.08 [ $g^2/Hz$ ]
$W_2$	0.022 [ $g^2/Hz$ ]
$f_1$	220 Hz
$f_2$	1220 Hz

**3.4.1.10 Combined Wind and Ice**

The system shall operate normally with 0.5-inch radial ice load in winds of 100 mph.

**3.4.1.11 Ice Loading**

The system shall operate and exhibit no adverse effects encased in clear ice up to 0.5-inch thick (radial).

**3.4.1.12 Ice Accumulation**

MALSR light sources shall not allow the accumulation of ice on the face of the light source when exposed to an ambient air temperature of  $-10^{\circ} C \pm 2^{\circ} C$  and water droplet temperature of  $0^{\circ} C$  to  $+3^{\circ} C$ .

**3.4.2 Non-operating Environmental Requirements**

The system shall not be damaged when stored or transported under conditions delineated in the non-operating conditions as specified in FAA-G-2100g.

**3.5 Electromagnetic Interference Requirements**

**3.5.1 Electromagnetic Radiation/Interference**

The MALSR equipment shall provide electromagnetic interference protection IAW the shielding requirement specified in FAA-STD-019d.

**3.5.1.1 Conducted Emission Interference**

Conducted emission interference levels from the MALSR system shall be no greater than the limits for CE102 as defined in MIL-STD-461. The frequency range shall be 10 kilohertz (kHz) to 10 megahertz (MHz).

**3.5.1.2 Radiated Emission Interference**

Radiated emission interference levels from the MALSR system shall be no greater than the limits for RE102 as defined in MIL-STD-461 with the exception that the frequency range tested shall be 2 MHz to 10 gigahertz (GHz). The RE102 limit shall be IAW Figure RE102-4 for ground applications. If the emission measurement is made at a distance other than one (1) meter, as described in MIL-STD-461, the RE102 limit line of Figure RE102-4 shall be adjusted, over the frequency range measured, for the distance at which the measurement is taken.

### **3.5.1.3 Conducted Susceptibility**

The MALSRS system shall meet the conducted susceptibility requirements of CS114 specified in MIL-STD-461. The frequency range shall be 10 kHz to 400 MHz, and Curve #2 of Figure CS114-1 of MIL-STD-461 shall be used for the limit IAW Table III for Air Force (AF) Ground Equipment.

### **3.5.1.4 Radiated Susceptibility**

+The MALSRS system shall meet the radiated susceptibility requirements of RS103 defined in MIL-STD-461. The frequency range shall be 2 MHz to 10 GHz. The electric field intensity shall be IAW the limits for AF ground equipment to Table VII RS103 limits for AF Ground Equipment of MIL-STD-461.

### **3.6 Electrostatic Discharge (ESD) Protection**

The MALSRS system, subsystems, and circuitry shall provide ESD protection to reduce the frequency of ESD events and to minimize the effects as specified in FAA-STD-019d. All electronic circuitry that contain miniaturized or solid-state components shall be considered ESD susceptible.

### **3.7 Maintainability Requirements**

System maintainability shall be in conformance with the maintainability requirements as specified in FAA-G-2100g. Diagnosis of a MALSRS Failure shall be no greater than 0.50 hours. The Mean-Time-To-Repair (MTTR) requirement shall be no greater than 0.50 hour after determination of the failure. The Mean Periodic Maintenance Time (MPMT) shall be no greater than 2 hours per calendar quarter, including routine inspection. MPMT shall be measured from when the FAA technician arrives on site to when the MALSRS system is operational.

### **3.8 Maintenance Test Points**

Test points shall be provided to allow measurement of performance parameters that confirm proper operation, and identify failed or faulty (performing out of specification) LRU while the system is operational. Light sources shall be LRUs. All test points and built-in test capabilities shall conform to the maintainability requirements as specified in FAA-G-2100g.

### **3.9 Reliability Requirements**

#### **3.9.1 System Reliability**

The MALSRS system level Mean Time Between Failures (MTBF) shall be greater than 2,500 hours with an objective of 25,000 hours.

#### **3.9.2 Structures and Enclosures**

MALSRS structures, enclosures, and components as defined in TABLE I shall be designed for thirty (30) years of use.

### **3.10 Personnel Safety and Health**

The system shall meet the personal safety and health requirements specified in FAA-G-2100g.

**3.11 Fail Safe**

The MALSR system shall be fail safe as defined in FAA-G-2100g

**3.12 Thermal Design**

The MALSR system shall conform to the thermal design requirements of FAA-G-2100g.

**3.13 Recycled, Recovered, or Environmentally Preferable Materials**

Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life-cycle costs.

**3.14 Fungus-Proof Materials**

Materials that are nutrients for fungi shall not be used

**4. VERIFICATION**

**4.1 Design Qualification Test**

The first manufactured MALSR unit is designated as the production model, which shall be the subject of the design qualification tests. The production model shall be subjected to qualification tests specified in Section 4.4, as required by the Requirements Verification Traceability Matrix in Appendix A, and the Maintainability and Reliability Demonstration Tests as specified in Sections 4.1.1 and 4.1.2. The production model and production units shall be populated with light sources for the tests. The production model, after successfully passing the test, shall be a deliverable as defined in the contract.

**4.1.1 Maintainability Demonstration**

Maintainability demonstration tests shall be performed to test conformance to the maintainability requirements as specified in FAA-G-2100g. The maintainability tests on the MALSR production model shall use Test Method 1 as specified in Appendix B of MIL-HDBK-470A. The tasks for the maintenance demonstration shall be chosen in conformance to Appendix B of MIL-HDBK-470A.

**4.1.2 Reliability Demonstration**

MALSR production model reliability demonstration tests shall be performed to test conformance to the requirements in FAA-G-2100g Section 3.2.3. If the reliability demonstration does not require interruption of the 150-hour test (see 4.4.32.1), then both tests may be performed concurrently. Reliability Demonstration Tests shall be IAW MIL-HDBK-781 Paragraph 4 and Test Plan XXI-D. All equipment shall be subjected to the test conditions of MIL-HDBK-781, Paragraph 4.3, except that no vibration conditions need be imposed. Equipment shall be duty cycled IAW 4.4.32.2 on a daily basis.

**4.2 Production Acceptance Test**

Testing of the production units shall start after acceptance of the production model. Tests on production units shall be as specified in 4.4, and as required by the Requirements Verification Traceability Matrix in Appendix A.

### **4.3 Type Acceptance Test**

Type acceptance testing shall be performed on a MALSR unit after successfully completing the Production Acceptance Test (see 4.2). The quantity of units that will undergo Type Testing shall be IAW the Type Test Equipment Selection Table in FAA-G-2100g. The Type Test shall be as specified in 4.4, and as required by the Requirements Verification Traceability Matrix in Appendix A.

### **4.4 Test Procedures**

Upon completion of each of the tests defined in 4.4.1 through 4.4.31, the equipment connected as a complete MALSR system shall undergo at least one operational test cycle specified in 4.4.32.1 (steps 1 through 6).

#### **4.4.1 Visual Inspection**

The equipment listed in section 3 shall be visually inspected for workmanship, fabrication, finishing, painting, and adequacy of selected parts as required in FAA-G-2100g and applied according to the Requirements Verification Traceability Matrix in Appendix A.

#### **4.4.2 Temperature Test**

The procedure for temperature testing shall be IAW Procedure I (non-operating) and Procedure II (operating) of Method 501.4 and Method 502.4 of MIL-STD-810F. The Environmental Tests for the photometric requirements of the LEDs outlined in 4.4.14 may be performed at this time also.

#### **4.4.3 Humidity Testing**

The procedure for humidity testing shall be IAW Method 507.4 of MIL-STD-810F.

#### **4.4.4 Altitude Test**

The altitude test shall be IAW Procedure I and Procedure II, Method 500.4 of MIL-STD-810F. The operation portion of the test shall be completed after holding the equipment at the low pressure for one (1) hour. Equipment shall be tested at atmospheric pressure corresponding to -300 feet (-92 meters) and 10,000 feet (3,048 meters) altitude at both operating temperature extremes. Procedure I shall use the non-operating system requirement values in Section 3.3.2. The altitude test and the temperature test (see 4.4.2 and 4.4.4) shall be combined.

#### **4.4.5 Sand and Dust Test**

The sand and dust tests shall be IAW Procedures I and II, Method 510.4, of MIL-STD-810F. The air velocities used in the sand and dust test shall be 5,700 ft/min (29m/s) and 1,750 ft/min (8.9m/s), respectively. The test durations shall be six (6) hours each and the equipment shall be rotated twice during the conduct of each test.

#### **4.4.6 Salt Fog Test**

The salt spray test shall be IAW MIL-STD-810F, Method 509.4. The equipment shall be exposed for two (2) 48-hour cycles of exposure and drying. One cycle consists of a 24 hour period of salt exposure followed by 24 hours of drying. Do not remove salt accumulation during the first drying period. At the conclusion of the test, salt build-up may be removed with tap water.

#### **4.4.7 Rain Test**

The rain test shall be IAW Procedure I, Method 506.4 of MIL-STD-810F. The wind velocity shall be 40 mph (18m/s), and the rainfall rate shall be 4 in/h (10cm/h). The test item temperature shall be at least  $10 \pm 3^{\circ}\text{C}$  ( $50 \pm 5.4^{\circ}\text{F}$ ) higher than the rain temperature at the beginning of each 30-minute exposure period.

#### **4.4.8 Thermal Shock Test**

The production model shall be installed as in normal use and operated at maximum lamp intensity until the temperature has stabilized. At least 3 gallons (11.53 liters) of water at a temperature of  $0^{\circ}\text{C}$  to  $+5^{\circ}\text{C}$  ( $32^{\circ}\text{F}$  to  $41^{\circ}\text{F}$ ) shall be sprayed on the top surface. There shall be no cracking of glass or metal and the units shall be operational during this test.

#### **4.4.9 Solar Radiation (Sunshine) Test**

The solar radiation test shall be IAW MIL-STD-810F, Procedure II, Method 505.4. The test shall be conducted for a total of three (3) cycles.

#### **4.4.10 Vibration Test**

Production models of the lighting units and any other components to be mounted on the frangible structures shall be vibration tested using the 3-axis version of Procedure 514.5 in MIL-STD-810F. The lights shall be tested while operating in high intensity mode. All system components, with the exception of the filament or lamp envelope if an incandescent light source is used, must remain fully functional and structurally intact under the vibration profile as defined by the curve in Procedure 514.5, Figure C-14 in MIL-STD-810F using the parameters presented in TABLE X.

If the filament or lamp envelope of an incandescent light source fails at any point, the test shall be continued and completed on the fixture alone, following which, a new lamp will be installed, and the fixture assembly shall be retested over a frequency range of 55 to 2000 Hz at three (3) gravity constants (Gs).

After the vibration test, the assembly shall be thoroughly examined for all damage including, but not limited to, mechanical failure of any component, loosening of any part, cracked or broken seals, continuity of electrical circuits, and possible damage to the light source. Furthermore, if the light source utilizes lensing to achieve the required photometrics, the light source shall be retested following the vibration test for compliance with the photometric requirements presented in 3.1.1 through 3.1.3.

#### **4.4.11 Wind and Ice Loading Tests**

The system shall operate while subjected to the combined wind and ice conditions specified in 3.4.1.10 and the ice conditions specified in 3.4.1.11 using the procedure described in MIL-STD-810F, Method 521.2. The vertical angle of the light assembly shall be measure before and after the test.

#### **4.4.12 Ice Accumulation Test**

The MALSRS light sources shall operate while subject to the conditions specified in 3.4.1.12 using the Procedure I, Method 521.2 of MIL-STD-810F and tailored as follows. The lamps shall

be placed in an environment with the front of the lamps angled at +25° to the horizontal, facing the water dispenser and with an air temperature of -10° C ± 2° C. The air temperature shall be stabilized at -10° C for two (2) hours. The lamps shall then be turned ON in high intensity and left to stabilize for 2 hours while keeping the air temperature constant at -10° C. Water shall then be introduced by suitable means at a temperature of 0° C to +3° C. Water droplet size shall be 1 mm to 1.5 mm in diameter. The water density shall be 5.5 ± 1 gram/cubic centimeter (g/cm<sup>3</sup>). The water delivery rate shall be 25 ± 2 millimeters/hour (mm/hr) with the exposure time being four (4) hours. No ice shall be allowed to accumulate on the face of the lamp.

#### **4.4.13 Sequenced Flasher Assembly Tests**

Tests shall be performed on eight (8) sequenced flasher assemblies to verify operating requirements presented in 3.1.3 and 3.1.4.9. All measurements shall be made at the input terminal to the light source.

#### **4.4.14 Photometric Tests**

Photometric tests shall be performed on the first article and first production light sources of the threshold, steady burning, and sequenced flasher light assemblies to provide conformance with the requirements in 3.1.1.2, 3.1.2.2, and 3.1.3.2. Candela measurements made in each test shall be IAW CIE DS010.2. All Candela measurements shall be made according to a 1° rectangular grid (similar to Figure 2-11 of ICAO 1999 Annex 14). Measurements shall be made at each of these grid-points inside of the specified beam patterns (see FIGURE 3, FIGURE 5, and FIGURE 7).

The tests shall be performed for all combinations of specified operational input voltages and fluctuations. If the sequence flasher power supply is not co-located, the test cable length from the sequenced flasher light assembly to the power source shall be 200 feet.

Unless otherwise specified, all tests shall be performed at room temperature (25°C ± 2°C).

##### **4.4.14.1 Threshold Light Tests**

All threshold light tests may incorporate a 15-minute warm-up period if desired.

##### **4.4.14.1.1 Threshold Light Maximum Intensity Test**

Maximum intensity for the threshold lights shall be measured at all three (3) intensity steps: Low, Medium, and High. Intensity, in Candela, shall be measured at each of the grid-points described in 4.4.14 within the beam pattern of ±6° horizontal and ±4° vertical (see FIGURE 3). The Maximum Intensity of all grid point measurements shall reside within ±3° of the light unit centerline and be less than the maximum allowable intensities stated in TABLE III.

##### **4.4.14.1.2 Threshold Light Minimum Intensity Test**

Using the data from the Threshold Light Maximum Intensity Test (see 4.4.14.1.1), no grid point measurement shall be less than the minimum allowable intensities stated in TABLE III.

##### **4.4.14.1.3 Threshold Light Average Intensity Test**

The threshold light average intensity shall be the arithmetic mean of all intensities measured at the grid-points (see 4.4.14) during the Maximum Intensity Test. The Average Intensity shall

reside within the maximum and minimum allowable intensities specified in TABLE II. Average intensity shall be calculated for all three (3) intensity steps: Low, Medium, and High.

#### **4.4.14.1.4 Threshold Light Chromaticity Test**

The threshold light source shall be tested for conformance to the aviation green color requirements defined in SAE AS25050 according to the CIE system defined in CIE DS 010.2 and ASTM E308-01 using the test procedures in Paragraph 4 of SAE AS25050. This chromaticity test shall be performed at all three (3) operating intensity levels.

#### **4.4.14.2 Steady Burning Light Tests**

All Steady Burning Light Tests may incorporate a 15-minute warm-up period if desired.

##### **4.4.14.2.1 Steady Burning Maximum Intensity Test**

Maximum intensity for the steady burning lights shall be measured at High Intensity. Intensity, in Candela, shall be measured at each of the grid-points described in 4.4.14, within the beam pattern of  $\pm 14^\circ$  in all directions (see FIGURE 5). The maximum intensity of all grid point measurements shall be located within  $\pm 3^\circ$  of the light unit centerline and be less than the maximum allowable intensities stated in 3.1.2.2.3..

##### **4.4.14.2.2 Steady Burning Average Intensity Test**

The steady burning light average intensity shall be computed for the Main Beam Pattern of the steady burning light. The average intensity shall be the arithmetic mean of all intensities measured at the grid-points during the Maximum Intensity Test. The average intensity shall reside within the maximum and minimum allowable intensities specified in 3.1.2.2.3. Average Intensity shall be calculated for all three (3) intensity steps: Low, Medium, and High.

##### **4.4.14.2.3 Steady Burning Chromaticity Test**

The steady burning light source shall be tested for conformance to the aviation white color requirements defined in SAE AS25050 according to the CIE system defined in CIE DS 010.2 and ASTM E308-01 using the test procedures in Paragraph 4 of SAE AS25050. This chromaticity test shall be performed at all three (3) operating intensity levels.

#### **4.4.14.3 Sequenced Flasher Light Tests**

##### **4.4.14.3.1 Sequenced Flasher Maximum Effective Intensity Test**

The Sequenced Flasher Light Tests shall utilize the effective intensity of the flash for all intensity measurements. Effective intensity measurements for light sources are outlined in FAA-E-1100a. All effective intensity measurements shall be made using a  $1^\circ$  rectangular grid like the one described in 4.4.14.

Maximum effective intensity for the sequenced flasher lights shall be measured at each of the three (3) intensity steps: Low, Medium, and High. Effective intensity, in Candela, shall be measured at each of the grid-points, within the beam pattern of  $\pm 15^\circ$  horizontal and  $\pm 5^\circ$  vertical (see FIGURE 7). The maximum measured effective intensity shall reside between the maximum and minimum allowable intensities specified in TABLE V.

#### **4.4.14.3.2 Sequenced Flasher Minimum Effective Intensity Test**

Using the data from the Flasher Maximum Effective Intensity Test, no grid point measurement shall be less than the minimum allowable intensities stated in TABLE V.

#### **4.4.14.3.3 Sequenced Flasher Average Effective Intensity Test**

The sequenced flasher average effective intensity shall be the arithmetic mean of all effective intensities measured at the grid-points during the Maximum Intensity Test. The average effective intensity shall reside within the maximum and minimum allowable intensities specified in TABLE V. Average effective intensity shall be calculated for all three (3) intensity steps: Low, Medium, and High.

#### **4.4.14.3.4 Sequenced Flasher Chromaticity Test**

The sequenced flasher light source shall be tested for conformance to the aviation white color requirements defined in SAE AS25050 according to the CIE system defined in CIE DS 010.2 and ASTM E308-01 using the test procedures in Paragraph 4 of SAE AS25050. This chromaticity test shall be performed at all three operating intensity levels.

#### **4.4.15 Sequenced Flasher Control Parameter Test**

The sequenced flasher test shall include the verification of the requirements of 3.1.4.8 and 3.1.4.9. For light sources triggered by capacitors, a capacitor discharge test verifying that bleeder resistor bleed down to 50V within one (1) minute.

#### **4.4.16 General Electrical Characteristic Tests**

The system shall be tested to the FAA-G-2100g requirements stated.

#### **4.4.17 Power and Signal Line Tests**

Tests shall be performed with the MALSR equipment operating at the high intensity level. The equipment shall restart automatically and in the same state of service before the interruption or shutdown is experienced due to the surges or transients. At the conclusion of the tests, the equipment shall be subjected to ten (10) cycles of the operational tests described in 4.4.32.1 (steps 1 through 6).

##### **4.4.17.1 Power Line Surge Tests**

Power line surge protection shall be verified IAW IEEE C62.45-2002. The 1.2/50  $\mu$ s – 8/20  $\mu$ s voltage/current waves at 20 KV and 10 KA ( $\pm$ 10%) respectively shall be coupled into all internal and external power interfaces. The MALSR system shall maintain normal operation through the application of a minimum of five (5) test surges per line.

##### **4.4.17.2 Input Power Voltage/Time Events Tests**

The MALSR facility power interface shall be tested for the voltage/time events as defined by the "Federal Aviation Administration Input Power Tolerance Envelope" described in Appendix 1 of FAA-G-2100g. Each 120 VAC leg of the 120/240 VAC input shall be tested for all conditions with the exception of "High-Frequency Impulse and Ringwave" and "Prohibited Region" conditions. The MALSR system shall maintain normal operation during voltage/time event application except where indicated otherwise.

#### **4.4.17.3 Signal Line Transient Tests**

All MALSR signal lines shall be tested for transients as specified in FAA-STD-019d. The 8/1000  $\mu$ s waveform from FAA-STD-019d, Table II shall be coupled into all signal lines. The MALSR system shall maintain normal operation through the application of a minimum of five (5) test transients per line.

#### **4.4.18 Power Consumption**

The MALSR power demand shall be tested at the facility input terminal block while the system is operating on High Intensity with the Sequenced Flashers activated.

#### **4.4.19 Fail Safe Test**

As required by FAA-G-2100g Paragraph 4.2.2.5, the system shall be tested for fail-safety. Failure conditions shall be implemented in a normally connected MALSR and the benign system response is verified.

#### **4.4.20 Interference Test**

The equipment shall be connected, as it would be operationally. Measurement of the conducted emission levels shall be IAW test method CE102 of MIL-STD-461E. Measurement of the conducted susceptibility shall be IAW test method CS114 of MIL-STD-461E. Measurement of the radiated emissions shall be IAW test method RE102 of MIL-STD-461E. Measurement of the radiated susceptibility shall be IAW test method RS103 of MIL-STD-461E.

#### **4.4.21 Elapsed Time Meter Test**

A demonstration shall verify that the elapsed time meters meet the requirements of 3.2.4. At each intensity, with the sequenced flashers off, verify that the reading on the elapsed time meter is within one minute of the stopwatch after one hour of operation at each intensity and hold their readings upon removal of power.

#### **4.4.22 Dielectric Test**

The production model shall be subjected to 60 Hz dielectric tests connected to all power and control inputs and output lines using twice the circuit voltage plus 1,000 volts peak for a period of one (1) minute. Any evidence of current leakage in excess of one milliamp shall be cause for rejection. After completion on the dielectric test, a 1,000 volts direct current (VDC) insulation tester shall be used to check the same points. The resistance to ground, as observed with the insulation tester, shall be greater than 30 megaohms ( $M\Omega$ ). Components not designed for this high voltage, such as small capacitors, rectifiers, and lightning arresters may be disconnected for this test. Production units shall be checked with an insulation tester.

#### **4.4.23 Electrostatic Discharge Test**

The MALSR equipment including controls, meters, test points, etc. shall withstand a static discharge for operational and non-operational conditions as described in FAA-G-2100.

#### **4.4.24 Grounding and Bonding Test**

Isolation between each conductor including AC neutral and all equipment single point grounds shall be measured with the circuit breakers and power switches in the ON position. The isolation

shall be 10 Mega-ohms or greater. All bonds shall be measured with a 4-terminal milli-ohmmeter. The bonds shall have a maximum resistance of 1 milliohm.

**4.4.25 Light Assembly Vertical Alignment Test**

Using a digital inclinometer or protractor, with .01-degree accuracy, placed upon the flat top surface of the light fixture, adjust the vertical angle of the lamp throughout its range of horizontal motion. The fixture shall meet the adjustment requirements of paragraph 3.2.2.5. At three points in the range of motion, demonstrate the locking mechanism of the light assembly.

**4.4.26 Light Assembly Mounting Base Demonstration**

Using the GFE mounting hardware demonstrate that the required light assemblies can be mounted on the applicable EMT, LIR structure, and frangible coupling IAW D-6292-7, D-6292-9, D-6292-13, D-6292-14, and D-6213-15, and D-6155-2.

**4.4.27 Convenience Outlets and Maintenance Lights**

The functionality of the convenience outlets and maintenance lights with respect to paragraphs 3.2.5 and 3.2.6 shall be demonstrated.

**4.4.28 Light Assembly Weight Test**

Using a digital scale with a 0.1 lb accuracy, weigh the light assembly (light source, light holder, and a light mounting base). Each light assembly type (threshold, steady burning, and sequenced flasher) shall not exceed the applicable weight requirements (see 3.2.2.2, 3.2.2.3, and 3.2.2.4).

**4.4.29 Control Cabinet Weight Test**

Using a scale with a 0.5 lb accuracy, weigh the fully populated control cabinet. The control cabinet weight shall not exceed the weight requirement in 3.2.1.1.4

**4.4.30 Sequenced Flasher Tester**

This test shall demonstrate the operation of all the test functions provided in the sequenced flasher tester, which are as follows;

1. Input voltage and current of the sequenced flasher unit
2. Flash Rate
3. Anode voltage for capacitive discharge xenon flash tubes or the lamp input voltage and current for other light sources.
4. Bleed down time for capacitive discharge xenon flash tubes
5. Interlock switch status
6. Trigger the Sequenced Flasher

**4.4.31 Aiming Device Test**

The contractor shall provide an aiming platform for mounting the light assembly to test the aiming device. The platform shall be calibrated to the same tolerances specified for the aiming devices. The platform shall permit verification of the angular reading taken from the mounted aiming device from 0° to 25° in ±0.5° increments. Using a digital scale with a 0.1 lb accuracy, weigh the light source aiming device.

#### **4.4.32 Functional Tests**

One (1) control cabinet, 18 threshold light assemblies, 45 steady burning light assemblies, five (5) supplemental enclosures, and five (5) sequenced flasher assemblies shall be connected as it would be operationally. The convenience outlets (see 3.2.6) shall undergo three (3) tests using an externally faulted load to verify proper operation of the ground fault interrupter and reset operations. Operation of the sequenced flasher light assemblies shall be attempted with any interlock switches in the open position to verify proper operation of the interlocks. All operating requirements of the equipment shall be checked over the full range of voltage input variations at the control cabinet power input terminal (see 3.1.4.1.5). The step operation of the components shall be verified through the remote control inputs (see 3.1.4.8) provided in the control cabinet.

##### **4.4.32.1 150-Hour Test**

A 150-hour continuous operation shall be performed on the production model test at ambient temperature  $+30^{\circ} \pm 10^{\circ}\text{C}$  ( $86^{\circ} \pm 18^{\circ}\text{F}$ ). All intensity steps shall be checked using the remote control inputs to cycle the system as follows:

1. Low intensity on for  $5 \pm 1$  minutes,
2. System off for 2 seconds maximum,
3. Medium intensity on for  $5 \pm 1$  minutes,
4. System off for 2 seconds maximum,
5. High intensity on for  $5 \pm 1$  minutes,
6. System off for  $60 \pm 10$  seconds,
7. Repeat cycle for 50 hours, starting with step 1,
8. Low intensity on for  $5 \pm 0.2$  seconds,
9. Medium intensity on for  $5 \pm 0.2$  seconds,
10. High intensity on for  $5 \pm 0.2$  seconds,
11. System off for  $17 \pm 3$  seconds,
12. Repeat cycle for 100 hours, starting with step 8.

During the first ten (10) cycles, the system response time to intensity step changes (see 3.1.4.1.3) shall be measured. The system performance parameters and test point shall be used to monitor the MALSRS system once every hour. The solid state switches shall function properly during the power off portions of the test and meet requirements in 3.3.1.1

The local control switch shall be manually cycled through the Low, Medium, and High intensity step positions a minimum of 20 times at the completion of the 150-hour test.

When a failure is detected (contractor test equipment generated) during the conduct of the test, the test shall be discontinued and the cause of the failure investigated. The test shall proceed only after the failure has been corrected. Light sources used in the 150-hour test shall not be a part of the FAA procurement and shall be replaced with new light sources prior to system delivery.

##### **4.4.32.2 Two-Hour Test**

The MALSRS system production units and site spares shall undergo a 2-hour continuous operational test using the remote control inputs as follows:

1. High intensity on for 1 hour  $\pm$ 2 minutes,
2. Cycle IAW 4.4.32.1 (steps 1 through 6) for 1 hour  $\pm$ 2 minutes.

The local control switch shall be manually cycled through the Off, Low, Medium, and High intensity positions a minimum of 20-times at the completion of the 2-hour test. This 2-hour test shall be performed at ambient temperature conditions (approximately 30°C).

#### **4.5 Test Instruments**

The manufacturer or the subcontracted testing laboratory performing the system tests shall provide adequate instrumentation for these tests as specified in FAA-G-2100g, Paragraph 4.2.4.

In addition, all instruments shall have documentation of its calibration within the six (6) months preceding the tests. Oscilloscopes and photometric equipment shall be calibrated every three (3) months during the test period. Alternating current instruments shall be true root mean square.

Temperature sensing elements shall be thermocouple. Each thermocouple shall be pre-tested by inserting it into a chamber of known temperature. The thermocouple shall be installed at points determined by the FAA representative. The thermocouples shall be secured in place with high temperature cement manufactured for this purpose.

#### **5. PACKAGING**

Packaging requirements shall be as specified in the contract.

#### **6. NOTES**

##### **6.1 Intended Use**

MALSR provides visual guidance to landing aircraft. The equipment is installed and operated in the approach area of an active landing runway. This specification is also valid for the Medium Intensity Approach Lighting System with Sequenced Flashing Lights (MALSF) with the exceptions that only three (3) sequenced flasher lights are used instead of five (5) to eight (8) and that these three (3) sequenced flasher lights are located at the 1,000 foot, 1,200 foot, and 1,400 foot steady burning light bars instead of being located beyond the steady burning light field.

##### **6.2 Instruction Books**

The requirement for instruction books should be considered when this specification is applied to a contract. If instruction books are required, specifications and standards that have been determined necessary and justified through program management studies must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The instruction books must be acquired under separate contract line item in the contract (see FAA-D-2494/b).

##### **6.3 Supersession Data**

This specification supersedes FAA-E-2325E dated May 22, 2000 and FAA-E-2325D dated January 3, 1984.

## **6.4 Design Considerations**

### **6.4.1 Solid State Switches**

Solid State Switches should be capable of switching "On" when commanded using appropriate trigger advance circuits within 1.0 microsecond of the Zero Crossover of either the voltage and/or current waveforms. The switching circuits should be capable of selecting the voltage or current waveforms as required.

#### **6.5.1.1 Zero Voltage Crossover Switching**

The design should allow the switching circuits to turn "On" from the "Off" state using the zero voltage crossover reference from the common leg. The unit must turn "On" within 1.0 microsecond of the Zero Voltage Crossover.

#### **6.4.1.1 Zero Current Crossover Switching**

Once the switching circuits have been turned "On", the design should allow the transition from one Intensity level to another using the zero current crossover reference from the common leg. The switching circuit should allow "Off" natural commutation of the device being turned "Off" to occur in the 4<sup>th</sup> quadrant of the current sine wave. The switching circuit should turn on the next device in less than 1.0 microsecond of the next zero current crossover event.

#### **6.4.1.2 Solid State Switch Protection**

All Solid State Switching devices should have additional "Snubber Circuits" to ensure there will be one circuit for the common mode and one for the transverse mode.

#### **6.4.1.3 Intensity Dwell Time**

All switching should be progressive and sequential through each Intensity step. The dwell on each Intensity step should be no less than 250 milliseconds and no longer than 500 milliseconds for each intermediate and transitional step. This allows the lamps to establish equilibrium in resistance and current at each specific Intensity level before switching to the next level.

### **6.4.2 Over Voltage Protection**

The MALSR control cabinet should be capable of measuring the root mean squared of the incoming facility voltage for both phase to neutral and phase to phase. The MALSR control cabinet should be able to determine if the incoming facility voltage is 10 percent above the nominal value.

When MALSR has been commanded to operate in the High intensity and has switched to High intensity, the Control Cabinet should initiate an over-ride to Medium intensity when the incoming facility voltage is 10 percent or more above the nominal line voltage. MALSR should remain in Medium intensity until the incoming facility voltage returns to less than 10 percent above nominal for at least 1 minute and no longer than 2 minutes before returning to the commanded High intensity. The Control Cabinet should display a visual indication of the over-ride operation when the input voltage is 10% above nominal, and High intensity is inhibited. The unit may accept commands to operate in Low intensity or to switch "Off" while in over-ride.

### **6.4.3 Transformers**

Transformers should be single-phase, 60 Hz, 120/240 volts primary. Temperature rise for any compound filled transformers incorporating a 180°C insulation system will be no greater than 115°C above a 40°C ambient under full load conditions. Temperature rise for any other transformer type will be no greater than 65°C above ambient under full load conditions. Transformer coils should be wound with copper conductors. Transformer excitation current will be no greater than eight (8) times the running primary full load current. All transformers used will provide two  $\pm 2.5$  percent full load current compensation taps (above and below normal) on the primary side. All transformer enclosures will be NEMA Type 4X made of 304 Stainless Steel or equivalent. All transformer enclosures will be grounded IAW NFPA No. 70, article 250d.

### **6.4.4 Non-Switching DC Power Supplies**

Isolation for non-switching DC power supplies will be IAW FAA-G-2100g, Paragraph 3.1.1.11.

### **6.4.5 Inverter Pulse-Width Modulation**

Inverter Pulse-Width-Modulation (PWM) may be used to provide infinite variable voltage to the primary tap of a transformer supplying power to the steady burning lights through a secondary harmonic filter. All harmonic content should be removed from the power supplied to the lighting field and also not fed back into the power lines.

### **6.5 Definitions**

Nationally Recognized Testing Laboratory (NRTL) - An organization which is recognized by Occupational Safety and Health Act (OSHA) in accordance with Appendix A of Title 29 of the Code of Federal Regulations CFR Part 1910.7 (29CFR1910.7).

Lowest Replaceable Unit (LRU) - An essential support item which is removed and replaced at the field level to restore the end item to operationally ready condition. Conversely, a non-LRU is a part, component, or assembly used in the repair of an LRU, when the LRU has failed and has been removed from the end item for repair.

### **6.6 Requirements Validation**

The MALSR Requirements documented in Section 3 have been validated, where applicable, through the decomposition of higher level requirements from various governing documents. These requirement traces are documented in the MALSR Requirements Validation Matrix (see Appendix B).

**APPENDIX A. MALSRS Verification Requirements Traceability Matrix**

Test Levels: DQT – Design Qualification Test, PAT – Production Acceptance Test, TYPE – Type Acceptance Test  
Verification Method: I – Inspection, A – Analysis, T – Test, D - Demonstration

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
1.	3.1	The MALSRS system shall be comprised of the main components and associated quantities listed in TABLE I.	I	I	I	4.4.1
2.	3.1.1.1	The MALSRS system shall interface with semi-flush threshold lights as specified in FAA-E-2968.	D			Contractor Determined
3.	3.1.1.2	The threshold light source shall meet all the following requirements over the environmental operating conditions specified in 3.4.1.	T		T	4.4.2 thru 4.4.12 4.4.32.1
4.	3.1.1.2.1	The threshold light beam shall exhibit an elliptical pattern defined by the standard ellipse equation: $\frac{X^2}{a^2} + \frac{Y^2}{b^2} = 1$	T		T	4.4.2 thru 4.4.12 4.4.14.1.1
5.	3.1.1.2.1	Where X is the horizontal axis and Y is the vertical axis. The outer bounds of the threshold beam (shown in FIGURE 3) shall be no closer than ±6° from the light unit centerline along the horizontal axis (a = 6°) and shall be no closer than ±4° from the light unit centerline along the vertical axis (b = 4°).	T		T	4.4.2 thru 4.4.12 4.4.14.1.1
6.	3.1.1.2.2	The aviation green output of the threshold lights shall produce three intensity steps that are selected at the control input.	D	D	D	4.4.2 thru 4.4.12 4.4.14.1.4 4.4.32.1
7.	3.1.1.2.2	Within the threshold beam pattern described in 3.1.1.2.1, and in FIGURE 3, the average intensity (see 4.4.14.1.3) shall be within the required levels for each intensity step as stated in TABLE II.	T		T	4.4.2 thru 4.4.12 4.4.14.1.3
8.	3.1.1.2.3	Within the threshold beam pattern described in 3.1.1.2.1, and in FIGURE 3, no measured intensity shall be less than the minimum allowable intensity listed in TABLE III for each intensity step.	T		T	4.4.2 thru 4.4.12 4.4.14.1.2
9.	3.1.1.2.3	Also, within the threshold beam pattern the maximum measured intensity shall be no greater than the maximum allowable intensity listed in TABLE III for each intensity step.	T		T	4.4.2 thru 4.4.12 4.4.14.1.1

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
10.	3.1.1.2.3	The maximum measured threshold light intensity shall reside within $\pm 3^\circ$ in all directions from the light unit centerline (see FIGURE 3).	T		T	4.4.14.1.1
11.	3.1.1.2.4	The color of the light emitted from the MALS-R threshold lights shall be Aviation Green as specified in SAE-AS25050.	T		T	4.4.14.1.4
12.	3.1.1.2.5	The threshold light array shall provide an electrical interface to the MALS-R control cabinet.	I	I		4.4.1
13.	3.1.1.2.5	The threshold light array electrical interface shall consist of all power and control signals necessary to operate the threshold light array in the modes described in 3.1.4.1 at a maximum distance of 3,000 feet from the control cabinet.	D		D	Contractor Determined
14.	3.1.1.2.5	The threshold light source Line Replaceable Unit (LRU) shall have a plug or socket mechanism for maintenance and disconnection of any threshold light.	I	I		4.4.1
15.	3.1.1.2.5	The plug or socket mechanism shall be accessible for maintenance IAW 3.7.	I/D	I/D		4.4.1 4.1.1
16.	3.1.1.2.5	The remaining threshold lights in the array shall operate when any one (1) or more threshold lights Source LRUs are disconnected or failed.	D			Contractor Determined
17.	3.1.2.1	The MALS-R system shall interface with semi-flush steady burning lights as specified in FAA-E-2968.	D			Contractor Determined
18.	3.1.2.2	The steady burning lights shall meet all the following over the environmental operating conditions specified in 3.4.1.	T		T	4.4.2 thru 4.4.12 4.4.32.1
19.	3.1.2.2.1	The steady burning light beam pattern shall be circular in shape (shown in FIGURE 5).	T		T	4.4.2 thru 4.4.12 4.4.14.2.1
20.	3.1.2.2.1	The outer bounds of the steady burning main-beam pattern shall be no closer than $\pm 10^\circ$ .	T		T	4.4.2 thru 4.4.12 4.4.14.2.1
21.	3.1.2.2.1	The steady burning outer beam pattern, which has lower intensity requirements, shall be no closer than $\pm 14^\circ$ .	T		T	4.4.2 thru 4.4.12 4.4.14.2.1
22.	3.1.2.2.2	The aviation white output of the steady burning light sources shall produce three intensity steps that are selected at the control input.	D	D	D	4.4.2 thru 4.4.12 4.4.14.2.3 4.4.32.1
23.	3.1.2.2.2	Within the steady burning main-beam pattern described in 3.1.2.2.1, the average intensity (see 4.4.14.2.2) shall be within the required levels as stated in TABLE IV.	T		T	4.4.2 thru 4.4.12 4.4.14.2.2

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
24.	3.1.2.2.3	The maximum measured intensity for the main beam of the steady burning light source on high intensity shall be less than 18,000 candela (see FIGURE 5).	T		T	4.4.2 thru 4.4.12
25.	3.1.2.2.3	The maximum measured intensity for the steady burning light source shall reside within $\pm 3^\circ$ from the light unit centerline (see FIGURE 5).	T		T	4.4.2 thru 4.4.12 4.4.14.2.1
26.	3.1.2.2.3	The maximum measured intensity for the outer beam of the steady burning light source on high intensity shall be less than 9,000 candela (see FIGURE 5).	T		T	4.4.2 thru 4.4.12 4.4.14.2.1
27.	3.1.2.2.4	The color of the light emitted from the MALSR steady burning lights shall be Aviation White as specified in SAE-AS25050.	T		T	4.4.2 thru 4.4.12 4.4.14.2.3
28.	3.1.2.2.5	The steady burning light array shall provide an electrical interface to the MALSR control cabinet.	I	I		4.4.1
29.	3.1.2.2.5	The electrical interface shall consist of all power and control signals necessary to operate the steady burning light array in the modes described in 3.1.4.1 to a maximum distance of 3,000 ft from the control cabinet.	D		D	Contractor Determined
30.	3.1.2.2.5	The steady burning light source LRU shall have a plug or socket mechanism for maintenance and disconnection of any steady burning light.	I	I		4.4.1
31.	3.1.2.2.5	The plug or socket mechanism shall be accessible for maintenance IAW 3.7.	I			4.4.1
32.	3.1.2.2.5	The remaining steady burning lights in the array shall operate when any one or more steady burning lights source LRUs are disconnected or failed.	D			Contractor Determined
33.	3.1.3	The flashing lights comprising sequenced flasher array shall flash sequentially, beginning with the sequenced flasher furthest from the threshold, towards the runway threshold at a rate twice per second..	D	D		4.4.13
34.	3.1.3	The sequenced flasher array shall have the ability to be turned off separately from the rest of the MALSR system.	D			4.5.13
35.	3.1.3.1	The MALSR system shall interface with semi-flush sequenced flashing lights (Type II) as specified in FAA-E-2628	D			Contractor Determined
36.	3.1.3.2	The sequenced flasher lights shall meet the following requirements over the environmental operating conditions specified in 3.4.1.	T		T	4.4.2 thru 4.4.12 4.4.14.3

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
37.	3.1.3.2.1	<p>The sequenced flasher beam shall exhibit an elliptical pattern defined by the standard ellipse equation:</p> $\frac{X^2}{a^2} + \frac{Y^2}{b^2} = 1$ <p>where X is the horizontal axis and Y is the vertical axis.</p> <p>The outer bounds of the sequenced flasher beam (see FIGURE 7) shall be no closer than ±15° from the light unit centerline along the horizontal axis (a = 15°) and shall be no closer than ±5° from the light unit centerline along the vertical axis (b = 5°).</p>	T		T	4.4.2 thru 4.4.12 4.4.14.3.1
38.	3.1.3.2.1	<p>The sequenced flashers shall produce three (3) intensity steps that are selected at the control input.</p>	D	D	D	4.4.2 thru 4.4.12 4.4.14.3.4 4.4.32.1
39.	3.1.3.2.2	<p>The average effective intensity (see 4.4.14.3.3) for the sequenced flasher at each intensity step shall be within the ranges shown in TABLE V.</p>	T	T	T	4.4.2 thru 4.4.12 4.4.14.3.3
40.	3.1.3.2.2	<p>Within the sequenced flasher beam pattern described in 3.1.3.2.1, no measured effective intensity shall any greater than the maximum or less than the minimum extremes described in TABLE V for each intensity step.</p>	T	T	T	4.4.2 thru 4.4.12 4.4.14.3.2
41.	3.1.3.2.3	<p>The color of the light emitted from the MALSR sequenced flasher lights shall be Aviation White as specified in SAE-AS25050.</p>	T	T	T	4.4.2 thru 4.4.12 4.4.14.3.4
42.	3.1.3.2.4	<p>The sequenced flasher array shall provide an electrical interface to the MALSR control cabinet.</p>	I	I	I	4.4.1
43.	3.1.3.2.5	<p>The electrical interface shall consist of all power and control signals necessary to operate the sequenced flasher array in the modes described in 3.1.4.1 to a maximum distance of 3,000 feet from the control cabinet.</p>	D		D	Contractor Determined
44.	3.1.3.2.5	<p>The sequenced flasher light source LRU shall have a plug or socket mechanism for maintenance and disconnection of any sequenced flasher light.</p>	I	I	I	4.4.1
45.	3.1.3.2.5	<p>The plug or socket mechanism shall be accessible for maintenance IAW 3.7.</p>	I/D	I/D	I/D	4.4.1 4.1.1

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
47.	3.1.3.2.5	The remaining sequenced flasher lights in the array shall operate when any one or more sequence flasher light LRUs are disconnected or failed.	A			N/A
48.	3.1.4	The MALSR control cabinet shall include the electrical, mechanical, and electronic components that provide control signals and power distribution to the light field.	I			4.4.1
49.	3.1.4	The control cabinet shall provide the circuitry and controls required to fully operate the MALSR system.	I/D	I/D		4.4.1 4.4.32.1 4.4.32.2
50.	3.1.4	MALSR controls shall provide the capability to perform the following: 1. Actuate the entire light field, 2. Switch between the three intensity levels for the threshold, steady burning, and flasher lights, 3. Turn OFF the flashers without disrupting the operation of the threshold and steady burning lights, 4. Trigger the sequencing of the flasher lights, 5. Turn OFF all lights in the MALSR system, 6. Operate through remote control.	I/D	I/D		4.4.1 4.4.32.1 4.4.32.2  <b>Capability #3 Not Tested in 150 hr test</b>
51.	3.1.4.1	The MALSR control cabinet shall allow both local (manual) and remote operational control of the light field and light intensity levels.	D	D		4.4.32.1 4.4.32.2
52.	3.1.4.1.1	The MALSR system shall provide two (2) switches in the control cabinet to perform the following local system control functions: 1. Sequenced Flasher ON/OFF, 2. Light Field Mode Control.	D	D		4.5.13 4.4.32.1 4.4.32.2  <b>Capability #1 Not Tested in 150 hr test</b>
53.	3.1.4.1.1	If incandescent lightening is used, the light field mode control switch and the sequenced flasher ON/OFF switches shall be rated for tungsten lamp electrical loads.	I			4.4.1
54.	3.1.4.1.1.1	A single throw switch shall be used to enable/disable the sequenced flasher array.	D			Contractor Determined
55.	3.1.4.1.1.1	The sequenced flasher ON/OFF control switch shall not allow both positions to be selected simultaneously.	D			Contractor Determined

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
56.	3.1.4.1.1.1	The position of the sequence flasher control ON/OFF switch shall have no effect on the operation of the rest of the MALSR light field (threshold and steady burning light arrays).	D			Contractor Determined
57.	3.1.4.1.1.1	Each functional position of the sequenced flasher ON/OFF control switch shall be identified by a mechanical detent as well as by a selection indicator.	I			4.4.1
58.	3.1.4.1.1.2	Each functional position of the Light Field Mode Control Switch shall be identified by a selection indicator.	I			4.4.1
59.	3.1.4.1.1.2	The switch shall provide the following functions: 1. System OFF (Local Control), 2. LOW Intensity (Local Control), 3. MEDIUM Intensity (Local Control), 4. HIGH Intensity (Local Control), 5. REMOTE control.	D	D		4.4.32.1 4.4.32.2
60.	3.1.4.1.1.2	The light field mode control switch shall not allow multiple positions to be selected simultaneously.	D	D		4.4.32.1 4.4.32.2
61.	3.1.4.1.2	When the light field mode control switch (see 3.1.4.1.1.2) is set to the "REMOTE" position, the MALSR system shall be externally controlled as described in 3.1.4.8.	D			4.4.32.1
62.	3.1.4.1.3	When operational, all lights in the MALSR system (threshold, steady burning, and sequenced flasher) shall function on one of three intensity settings: LOW, MEDIUM, and HIGH.	D	D		4.4.32.1 4.4.32.2
63.	3.1.4.1.3	Regardless of control method, the entire MALSR light field shall be set to the same intensity level based on the intensity setting.	D			4.4.32.1 4.4.32.2
64.	3.1.4.1.3	Changing the intensity step to a different setting shall change the intensity of all lights in the MALSR light field.	D	D		4.4.32.1 4.4.32.2
65.	3.1.4.1.3	All intensity step changes (including to/from off conditions) shall be completed within two (2) seconds of the applied control signal.	T	T	T	4.4.32.1
66.	3.1.4.1.4	The control switches described in 3.1.4.1.1 and 3.1.4.1.1.2 shall produce the MALSR light field functionality as described in TABLE VI.	D	D	D	4.4.32.1 4.4.32.2
67.	3.1.4.1.5	The control switches described in 3.1.4.1.1 and 3.1.4.1.1.2 shall produce the MALSR intensity level switching sequence and minimum dwell time as described in TABLE VII.	T		T	Contractor Determined

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
68.	3.1.4.2	Power for all subsystems within the MALSR, including the light field, shall be derived from the facility power source specified below.	I	I		4.4.1
69.	3.1.4.2.1	The MALSR system power demand, with sequenced flashers on and the system on high intensity shall be less than 14 kilowatts (kW) with an objective of 2.8 kW.	T	T	T	4.4.18
70.	3.1.4.2.2	The facility power interface for the MALSR system shall be four wire, 120/240 volts, 60 Hertz (Hz), single phase, alternating current consisting of L1, L2, Neutral, and equipment grounding conductor.	N/A			N/A
71.	3.1.4.2.2	The MALSR system shall not experience performance degradations with input power voltage variations as specified in FAA-G-2100g.	T		T	4.4.16
72.	3.1.4.2.3	The MALSR system shall not be damaged or experience performance degradations with steady state and momentary deviations in input power frequency as specified in FAA-G-2100g.	T		T	4.4.16
73.	3.1.4.2.4	Load balancing shall meet the electrical load balance requirements specified in FAA-G-2100g.	T		T	4.4.16
74.	3.1.4.2.5	The MALSR system shall limit the maximum surge current to less than four (4) times the full load operating current.	T		T	Contractor Determined
75.	3.1.4.2.5	The addition of line reactors or increased transformer leakage inductance within the MALSR System shall have no effect on the overall efficiency, nor result in a system output impedance exceeding two (2) percent of the system load.	T		T	Contractor Determined
76.	3.1.4.2.6	The MALSR system harmonics shall meet the input power harmonic requirements specified FAA-G-2100g.	T		T	4.4.16
77.	3.1.4.2.6	The MALSR system shall not experience performance degradations caused by input power harmonic distortions as specified in FAA-G-2100g.	T		T	4.4.16
78.	3.1.4.2.7	The MALSR system power factor shall meet the power factor requirements as specified in FAA-G-2100g.	T		T	4.4.16
79.	3.1.4.3	The MALSR control cabinet shall contain the circuit termination point for the input power interface from a distribution panel.	I	I		4.4.1
80.	3.1.4.3	A sub-panel within the control cabinet shall be used to house the power termination point, the main disconnect circuit breaker, subsystem disconnect circuit breakers, neutral bus, grounding bus, and all MALSR power distribution fuses.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
81.	3.1.4.3.	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence. The MALSR control cabinet shall provide a power distribution system to the threshold, steady burning, and sequenced flasher arrays in the configuration outlined in the MALSR installation drawings D-6292-3.	I	I		4.4.1
82.	3.1.4.3.1	The disconnect circuit breakers shall be selected IAW NFPA 70 and FAA-G-2100g.	I	I		4.4.1
83.	3.1.4.3.1	The disconnect circuit breakers shall be meet the circuit overload protection requirements as specified in FAA-G-2100g.	T		T	4.5.16.1
84.	3.1.4.3.1	The disconnect circuit breaker shall be sufficient to operate the MALSR subsystems in all normal operating modes.	D	D		4.4.32.1
85.	3.1.4.3.1	Solid-state switches shall not be used as disconnect circuit breaker.	I	I		4.4.1
86.	3.1.4.3.1.1	A main power disconnect circuit breaker shall be used to control the application of power within the MALSR system.	I	I		4.4.1
87.	3.1.4.3.1.1	The MALSR system shall have a main disconnect circuit breaker that provides circuit protection and power disconnect capabilities for the entire system, except as noted in 3.2.5 and 3.2.6.	I	I		4.4.1
88.	3.1.4.3.1.2	Subsystem disconnect circuit breakers shall be provided to control the application of power and provide protection to the threshold light array, the steady burning light array, the sequenced flasher light array, the remote control terminal block, and the sequenced flasher control circuitry.	I	I		4.4.1
89.	3.1.4.3.1.2	When the MALSR system is de-energized through the main power disconnect breaker, regardless of operating mode (local or remote), the input side of all subsystem power disconnect circuit breakers shall be open circuited.	I	I		4.4.1
90.	3.1.4.3.2.1	Power interfaces within the MALSR system shall be protected from any conducted power line surges as specified in FAA-STD-019d.	T			4.4.17 4.4.17.1 4.4.17.2 4.4.17.3
91.	3.1.4.3.2.2	The power interfaces within the MALSR system shall provide conducted line transient protection as specified in FAA-STD-019d.	T			4.4.17 4.4.17.1 4.4.17.2 4.4.17.3

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
92.	3.1.4.3.2.2	Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.  The system shall be operational when exposed to a combination waveform consisting of a 1.2/50 microsecond ( $\mu$ s) voltage spike at 10 kilovolts (kV) and an 8/20 $\mu$ s current spike at 10 kiloamps (kA).	T			4.4.17 4.4.17.1 4.4.17.2 4.4.17.3
93.	3.1.4.3.2.3	The MALSR system performance shall not be damaged by facility power input voltage conditions outside those specified in 3.1.4.2.2.	T			4.4.17.2
94.	3.1.4.3.2.3	The 120/240 volts (V) circuits within the MALSR system shall maintain normal operation during voltage/time events as defined by the "FAA Input Power Tolerance Envelope" presented in Appendix 1 of FAA-G-2100g.	D	D		4.4.17.2
95.	3.1.4.3.2.4	The MALSR system performance shall not be damaged by facility power outage conditions.	D	D		4.4.17 4.4.17.1 4.4.17.2 4.4.17.3
96.	3.1.4.3.2.4	When facility power is restored following an outage, the MALSR system, when in local control as outlined in 3.1.4.1.1, shall return to the same state of service as before the power outage.	D	D		4.1.1
97.	3.1.4.4	The MALSR system shall not be damaged by any interface disturbance at any of the following internal and external interfaces within the MALSR system unless otherwise indicated: remote control terminal block, threshold light array, steady burning light array, and sequenced flasher array.	N/A			N/A
98.	3.1.4.4.1	The MALSR signal interfaces shall provide conducted line transient protection as specified in FAA-STD-019d.	T			4.4.17.3
99.	3.1.4.5	The MALSR control cabinet shall provide power necessary to operate the threshold light array as described in 3.1.4.3.2 and 3.1.4.1.5	D	D		4.4.32.1 4.4.32.2
100.	3.1.4.5	The MALSR control cabinet shall provide control signals necessary to operate the threshold light array in the manual and remote modes as described in 3.1.4.1.1 and 3.1.4.8.5.	D	D		4.4.32.1 4.4.32.2
101.	3.1.4.6	The MALSR control cabinet shall provide power necessary to operate the steady burning light array as described in 3.1.4.3.2 and 3.1.4.1.5	D	D		4.4.32.1 4.4.32.2
102.	3.1.4.6	The MALSR control cabinet shall provide control signals necessary to operate the steady burning light array in the manual and remote modes described in 3.1.4.1.1 and 3.1.4.8.5.	D	D		4.4.32.1 4.4.32.2

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
103.	3.1.4.7	The MALSR control cabinet shall provide power necessary to operate the sequenced flasher light array as described in 3.1.4.3.2 and 3.1.4.1.5	D	D		4.4.32.1 4.4.32.2
104.	3.1.4.7	The MALSR control cabinet shall provide control signals necessary to operate the sequenced flasher light array in the manual and remote modes described in 3.1.4.1.1 and 3.1.4.8.5.	D	D		4.4.32.1 4.4.32.2
105.	3.1.4.8.1	Termination of the remote control signal lines shall be provided in a remote control terminal block.	I	I		4.4.1
106.	3.1.4.8.1	The remote control terminal block shall meet the requirements in 3.2.3.	I	I		4.4.1
107.	3.1.4.8.2	The remote control terminal block shall provide an interface for eight (8) signals as described in TABLE VIII.	I	I		4.4.1
108.	3.1.4.8.2	When the light field mode control switch is in the REMOTE control position, the MALSR shall be controlled through the signals received from the Remote Control Terminal Block.	I/D	I/D		4.4.1 4.4.32.1 4.4.32.2
109.	3.1.4.8.3	The maximum MALSR current loading for any single remote control input Terminals (3, 4, 5, 7) shall be 500 milliamps (mA).	T	T		4.4.15
110.	3.1.4.8.4	When individually or when any combination of Terminals 3, 4, 5, 7 are set to 120 VAC when referenced to ground, the terminals shall be considered ON (energized).	D	D		4.4.32.1 4.4.32.2
111.	3.1.4.8.4.1	Remote Control Terminal 1 shall be internally connected to 120 VAC power.	I	I		4.4.1
112.	3.1.4.8.4.2	When the Terminal 1, 120 VAC, signal is present on terminals 3 through 5 in one of the mapped combinations shown in TABLE IX, it shall be interpreted by the MALSR system as an active or enable condition for the steady burning and threshold lights to operate on that intensity level.	D	D		4.4.32.1 4.4.32.2
113.	3.1.4.8.4.3	When the 120 VAC signal is present on Terminal 7 as shown in TABLE IX, it shall be interpreted by the MALSR system as an active or enable condition for the sequenced flashers to operate on the intensity level mapped by terminals 3 through 5.	D	D		4.4.32.1 4.4.32.2
114.	3.1.4.8.4.4	Terminal 8 shall be connected to the neutral bus internal to the MALSR system.	I	I		4.4.1
115.	3.1.4.8.5	The remote control signals described in 3.1.4.8.4 through 3.1.4.8.4.4 shall provide the following MALSR system functionality as described in TABLE IX.	D	D		4.4.32.1 4.4.32.2

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
116.	3.1.4.9.1	The flasher sequence shall consist of eight (8) flasher triggers beginning with the flasher farthest from the runway threshold and proceeding to the flasher closest to the runway threshold.	N/A			N/A
117.	3.1.4.9.1	The flasher sequence shall be triggered 120 times a minute regardless of the number of flasher units present.	T	T	T	4.4.13
118.	3.1.4.9.1	The triggering of any flasher sequence shall coincide with the first Flasher Trigger.	D	D	D	4.4.13
119.	3.1.4.9.1	The time between the start of consecutive flash sequences shall be 0.5 ±0.015 seconds.	T	T	T	4.4.13
120.	3.1.4.9.2	MALSR flasher trigger and timer circuits shall be designed to accommodate a maximum of eight (8) flasher light sources (units) in the array.	I	I		4.4.1
121.	3.1.4.9.2	For the five (5) sequenced flasher configuration, trigger number 6, 7, and 8 shall be left unconnected.	I	I		4.4.1
122.	3.1.4.9.3	The flash duration shall be no greater than 5.5 milliseconds (ms) and no less than 0.25 ms.	T	T	T	4.4.13
123.	3.1.4.9.4	The interval between flashes of adjacent units shall be 33.3 ±0.1 ms.	T	T	T	4.4.13
124.	3.1.4.9.5	The failure of one or more flashers in the array shall have no effect on the operation of the remaining units.	D	D		4.4.13
125.	3.1.4.9.6	A flasher unit shall not fire without a flasher trigger.	D	D		4.4.13
126.	3.1.4.9.7	Flasher unit misfiring shall be less than 1 percent over 60 minutes with no misfires occurring on adjacent flasher units consecutively.	T	T	T	4.4.13
127.	3.1.4.10	The MALSR control cabinet shall be capable of displaying a visual indication of all current operational commands received manually (locally), or remotely.	D		D	Contractor Determined
128.	3.1.4.10.1	The System Status / Diagnostic Display shall be capable of displaying the current operating modes to include: System On, System Off, Low Intensity, Medium Intensity, High Intensity, Sequence Flashers On, and Sequence Flashers Off.	D		D	Contractor Determined
129.	3.1.4.10.2	The System Status / Diagnostic Display shall be capable of displaying all diagnosed faults within the control circuitry.	D		D	Contractor Determined
130.	3.1.4.10.3	The System Status / Diagnostic Display shall be capable of displaying the flasher sequence rate, individual flasher trigger pulses, the flash interval, and out-of-specification warnings.	D		D	Contractor Determined

REQ NUMBER	Section	Requirement Statement Note: if there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
131.	3.1.5.1	A single alignment device shall be provided to aim threshold, steady burning, and sequenced flashing lights installed in all possible mounting configurations detailed in 3.2.2.6.1, 3.2.2.6.2, and 3.2.2.6.3.	D	D		4.4.31
132.	3.1.5.1.1	The alignment device shall indicate aiming angle on a scale calibrated in at least 1° increments and be accurate to within ±0.5° of the actual angle with the device attached.	D	D		4.4.31
133.	3.1.5.1.1	The alignment device shall provide light source vertical alignment to within ±1° of the desired aiming angle following the removal of the alignment device.	D	D		4.4.31
134.	3.1.5.1.1	The alignment device shall permit field aiming of the light beam at any angle from 0° to +25° above the horizontal.	D	D		4.4.31
135.	3.1.5.1.2	The alignment device shall allow the operator to aim lights without the need for tools.	D	D		4.4.31
136.	3.1.5.1.2	The alignment device shall not require the disassembly of any part of the light assembly or removal of the light source to complete the aiming activity.	D	D		4.4.31
137.	3.1.5.1.2	The alignment device shall be capable of aiming threshold and steady burning lights when mounted on low impact resistant structures that conform to FAA-E-2604 or FAA-E-2702.	D	D		4.4.31
138.	3.1.5.1.2	The alignment device shall retain its reading when the tower is lowered.	D	D		4.4.31
139.	3.1.5.1.2	Starting with the structure in the elevated position, the alignment device shall permit aiming from the ground after lowering the structure parallel to the runway centerline a maximum of two (2) times (including installation and removal of the alignment device).	D	D		4.4.31
140.	3.1.5.1.3	The alignment device shall weigh no more than two (2) lbs.	T			4.4.31
141.	3.1.5.1.3	The alignment device shall be constructed of non-corrosive material.	I	I		4.4.1
142.	3.1.5.1.3	The alignment device shall have no loose parts.	I	I		4.4.1
143.	3.1.5.1.3	Self-retaining fastening devices shall be used to assemble any parts.	I	I		4.4.1
144.	3.1.5.1.3	The alignment device shall provide means to retain an alignment reading when subject to movement or transport.	I	I		4.4.1
145.	3.1.5.1.3	If the alignment device is mechanical, it shall have an enclosed dial and stop brake to hold the reading.	I	I		4.4.1
146.	3.1.5.1.3	If the alignment device is electrical, it shall be battery powered	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement	DQT	PAT	TYPE	Verification Section
147.	3.1.5.1.4	The alignment device shall operate in the environmental conditions specified in 3.4.1 with the exception of 3.4.1.10 through 3.4.1.11.	A			N/A
148.	3.1.5.1.4	The alignment device shall operate in winds of 25 knots gusting to 35 knots.	A			N/A
149.	3.1.5.1.5	The alignment device stored in its transport case shall be transportable by one person.	I	I		4.4.1
150.	3.1.5.1.5	The alignment device transport case shall protect the alignment device from damage when subjected to drops from a height of four (4) feet at any angle on any axis.	A			N/A
151.	3.1.5.2.1	The MALSR system shall have a sequenced flasher test interface at the supplemental enclosure for each sequenced flasher.	I	I		4.4.1
152.	3.1.5.2.1	The interface shall provide for a sequenced flasher test unit to verify correct operation of the MALSR flasher control parameters as described in 3.1.4.9.	T	T	T	4.4.30
153.	3.1.5.2.2	The interface shall allow for identification of failures and out of specification performance of sequenced flasher units and control circuitry to the LRU level.	D	D		4.4.30
154.	3.1.5.2	The sequenced flasher test unit shall identify the following: 1. Input voltage and current of the sequenced flasher unit 2. Flash Rate 3. Anode voltage for capacitive discharge xenon flash tubes or the lamp input voltage and current for other light sources. 4. Bleed down time for capacitive discharge xenon flash tubes 5. Interlock switch status	T	T		4.4.30
155.	3.1.5.2.3	The sequenced flasher test unit shall provide all measurement functions in two (2) or less operator actions.	D	D		4.4.30
156.	3.1.5.2.3	LRU fault isolation shall be accomplished by a single test.	D	D		4.4.30
157.	3.1.5.2.3	The sequenced flasher test unit display shall be visible under all ambient lighting conditions	D	D		4.4.30
158.	3.1.5.2.3	Linear electrical data and out of tolerance values shall be displayed in engineering units.	D	D		4.4.30
159.	3.1.5.2.3	LRU information shall be displayed in English language formats without the use of special codes or look-up tables	D	D		4.4.30
160.	3.1.5.2.3	The sequenced flasher test unit shall have the capability to trigger a sequenced flasher.	D	D		4.4.30

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
161.	3.1.5.2.4	The sequenced flasher tester unit shall operate in the environmental conditions specified in 3.3 with the exception of 3.4.1.10 through 3.4.1.11.	A			N/A
162.	3.1.5.2.4	The sequenced flasher tester unit shall operate in winds of 25 knots gusting to 35 knots.	A			N/A
163.	3.1.5.2.5	The sequenced flasher tester shall be portable.	I	I		4.4.1
164.	3.1.5.2.5	The sequenced flasher tester transport case shall protect the sequenced flasher tester from damage when subjected to drops from a height of four (4) feet at any angle on any axis.	A			N/A
165.	3.2	Hardware components selected/defined for use in the MALSR system shall meet the Materials, Processes, and Parts requirements as specified in FAA-G-2100g.	I	I		4.4.1
166.	3.2	No moving parts (i.e. relays, contactors, fans) shall be incorporated in the MALSR system	I	I		4.4.1
167.	3.2.1.1	The MALSR system shall contain a control cabinet.	I	I		4.4.1
168.	3.2.1.1.1	The control cabinet shall provide an internal ground lug located in the inside bottom edge of the cabinet and electrically connected (not isolated) from the control cabinet.	I	I		4.4.1
169.	3.2.1.1.1	The ground lug shall be compatible with the enclosure type.	I	I		4.4.1
170.	3.2.1.1.1	The ground lug shall accept the gauge of the grounding conductor which shall be of the same gauge of the phase conductors as required for the design of the system based on the NEC and FAA-G-2100g.	I	I		4.4.1
171.	3.2.1.1.1	If multiple grounding conductors are used, the ground lug shall have a multiple conductor type lug.	I	I		4.4.1
172.	3.2.1.1.2	The control cabinet shall not bend or distort under normal commercially accepted methods of shipping, handling, storage, and installation.	I	I		4.4.1
173.	3.2.1.1.3	The control cabinet shall be no greater than 40 inches tall, 29 inches wide and 16 inches deep.	I	I		4.4.1
174.	3.2.1.1.4	The control cabinet shall weigh no greater than 85 pounds.	T	T		4.4.29
175.	3.2.1.1.5	Materials used for the control cabinet shall meet the material requirements specified in FAA-G-2100g.	I	I		4.4.1
176.	3.2.1.1.5	NEMA 4X type enclosures made of 304 Stainless Steel, as defined in the NEMA 250 standard, shall be used even if the system element is located inside of a shelter.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
177.	3.2.1.1.5	The control cabinet shall operate under the environmental conditions specified in 3.4.1	T		T	4.4.2 thru 4.4.12
178.	3.2.1.1.6	The control cabinet shall provide integral vertical mounting provisions external to the enclosure so that it can be mounted inside a shelter (see D-6292-19) and on an external frame (see D-6292-5).	I	I		4.4.1
179.	3.2.1.1.6	External mounting studs shall not protrude through the internal surface of the control cabinet wall.	I	I		4.4.1
180.	3.2.1.1.7	Control cabinet subassemblies shall be mounted on a panel attached to the rear interior cabinet wall using studs.	I	I		4.4.1
181.	3.2.1.1.7	All subassemblies shall be attached to the panel using fasteners as specified in FAA-G-2100g.	I	I		4.4.1
182.	3.2.1.1.7	Internal mounting studs shall not protrude through the external surface of the control cabinet wall.	I	I		4.4.1
183.	3.2.1.1.8	The control cabinet door shall be hinged vertically, opening to the right side when the cabinet is mounted in a vertical, upright position.	I	I		4.4.1
184.	3.2.1.1.8	A control cabinet doorstop shall be provided for locking the door in a 120° (±15°) open position.	I	I		4.4.1
185.	3.2.1.1.8	Electrical components and cables shall not be attached to the control cabinet door.	I	I		4.4.1
186.	3.2.1.1.8	Continuous gaskets, commensurate with specified environmental operating conditions (see 3.3) and electromagnetic interference (see 3.5), shall be used to seal the control cabinet with the door in the closed position.	I	I		4.4.1
187.	3.2.1.1.8	Grounding of the control cabinet door shall be IAW the hinged panels and doors requirements as specified in FAA-G-2100g.	D	I		4.4.24
188.	3.2.1.1.9	The control cabinet door handle lever shall include provisions for a security padlock.	I	I		4.4.1
189.	3.2.1.1.9	The padlock holes in the control cabinet door handle shall be aligned to accommodate a six (6) inch long by 3/8-inch diameter horizontal rod when the door handle is in the locked position and the cabinet is oriented in a vertical upright position.	I	I		4.4.1
190.	3.2.1.1.9	The control cabinet door handle shall be within ±22° of vertical when in the locked position.	I	I		4.4.1
191.	3.2.1.1.9	When closed and locked, the control cabinet door shall remain closed and locked regardless of the installed padlock shaft diameter.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
192.	3.2.1.1.10	The control cabinet shall contain a sub-panel to house the facility power interface circuitry as specified in 3.1.4.1.5 and local control switches as specified in 3.1.4.1.1.	I	I		4.4.1
193.	3.2.1.1.10	The control cabinet power sub-panel shall be hinged.	I	I		4.4.1
194.	3.2.1.1.10	The MALSR Light Mode Control Switch, Sequenced Flasher ON/OFF Switch, all Circuit Disconnect Breakers, and all fuses shall be accessible when the control cabinet power sub-panel is in the closed position.	I	I		4.4.1
195.	3.2.1.1.10	The control cabinet power sub-panel shall be held closed by a minimum of two (2) captive screws.	I	I		4.4.1
196.	3.2.1.1.11	The component layout within the control cabinet shall provide adequate clearance for field installation and maintenance.	I	I		4.4.1
197.	3.2.1.1.11	Power and control signal terminal blocks shall be located near cable entry locations.	I	I		4.4.1
198.	3.2.1.1.11	The MALSR control cabinet shall meet accessibility requirements as specified in FAA-G-2100g.	D	D		4.1.1
199.	3.2.1.1.12	The inside of the control cabinet door shall facilitate the attachment of a laminated detailed electrical interconnection schematic of the control cabinet.	I	I		4.4.1
200.	3.2.1.2	The MALSR system may contain supplemental enclosures.	I	I		4.4.1
201.	3.2.1.2	The quantity of supplemental enclosures shall be no greater than the number of sequenced flasher units.	I			4.4.1
202.	3.2.1.2.1	Supplemental enclosures shall meet the ground lug requirements specified in 3.2.1.1.1.	I	I		4.4.1
203.	3.2.1.2.2	Supplemental enclosures shall meet the cabinet construction requirements in 3.2.1.1.2.	I	I		4.4.1
204.	3.2.1.2.3	Supplemental enclosures shall meet the cabinet materials requirements in 3.2.1.1.5.	I	I		4.4.1
205.	3.2.1.2.4	Supplemental enclosures shall provide integral vertical mounting provisions external to the enclosure.	I	I		4.4.1
206.	3.2.1.2.4	If the supplemental enclosure is to be used within the runway safety area or runway object free area, mounting provisions shall include two 2-inch threaded fittings on the bottom surface together with mounting lugs located on the rear surface.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement Note: if there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
207.	3.2.1.2.4	A third fitting shall be furnished on the bottom surface of the supplemental enclosure to accommodate a 0.75 inch flexible conduit.	I	I		4.5.1
208.	3.2.1.2.4	External mounting studs on the supplemental enclosure shall not protrude through the internal surface of the enclosure wall.	I	I		4.5.1
209.	3.2.1.2.5	Internal mounting studs on the supplemental enclosure shall not protrude through the external surface of the enclosure wall.	I	I		4.5.1
210.	3.2.1.2.6	The supplemental enclosure door shall be hinged vertically, opening to the right side when the cabinet is mounted in a vertical, upright position.	I	I		4.5.1
211.	3.2.1.2.6	Electrical components and cables shall not be attached to the supplemental enclosure door.	I	I		4.4.1
212.	3.2.1.2.6	Continuous gaskets, commensurate with specified environmental operating conditions (see 3.3) and electromagnetic interference (see 3.5), shall be used to seal the supplemental enclosure with the door in the closed position.	I	I		4.4.1
213.	3.2.1.2.6	Grounding of a supplemental enclosure door/cover shall be IAW the hinged panels and doors requirements as specified in FAA-G-2100g.	D	I		4.4.24
214.	3.2.1.2.7	Supplemental enclosures shall meet the component layout requirements in 3.2.1.1.11.	I	I		4.4.1
215.	3.2.1.2.8	Supplemental enclosures shall meet the wiring diagram attachment requirements in 3.2.1.1.12.	I	I		4.4.1
216.	3.2.2	Unless otherwise specified, the following light source requirements shall apply to each light assembly in the threshold light array, steady burning light array, and the sequenced flasher array.	N/A			N/A
217.	3.2.2.1	The light assembly shall consist of a light source, light holder, and a light-mounting base.	I	I		4.4.1
218.	3.2.2.1	Each above light assembly shall contain the hardware necessary to mount one (1) light.	I	I		4.4.1
219.	3.2.2.1	The light assembly shall be painted Aviation Orange in accordance with FED-STD-595.	I			4.4.1
220.	3.2.2.2	The complete threshold light assembly shall weigh no more than 6.5 pounds (lbs).	T			4.4.28
221.	3.2.2.3	The complete steady burning light assembly shall weigh no more than 1.5 lbs when install on a frangible coupling or EMT conduit.	T			4.4.28

REQ NUMBER	Section	Requirement Statement Note: if there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	DQT	PAT	TYPE	Verification Section
222.	3.2.2.3	The complete steady burning light assembly shall weigh no more than 1.0 lb when installed on a LIR structure Tee-Bar.	T			4.4.28
223.	3.2.2.4	The complete sequenced flasher assembly shall weigh no more than 6.5 lbs.	T			4.4.28
224.	3.2.2.5	The light assembly shall provide continuous vertical adjustment of the light beam axis from 0° horizontal to 25° above horizontal.	D	I		4.4.1 4.4.25
225.	3.2.2.5	The light assembly shall permit vertical alignment of the light beam to any vertical angle within ±0.5°.	D	I		4.4.1 4.4.25
226.	3.2.2.5	A locking mechanism shall be provided to securely lock each light assembly in its set position.	D	I		4.4.1 4.4.25
227.	3.2.2.5	The light shall operate over the entire vertical alignment range.	D	I		4.4.1 4.4.25
228.	3.2.2.5	The light assembly locking mechanism shall keep the light aligned while exposed to the wind and ice loading requirements specified in 3.4.1.10, and 3.4.1.11.	T			4.4.11
229.	3.2.2.6	The light assembly mounting base shall provide rigid mechanical support for one (1) light source holder.	I	I		4.4.1
230.	3.2.2.6	The light assembly mounting base shall have an internal wire-way that provides an interface to all signal and power wires from the bottom of the light mounting base.	I	I		4.4.1
231.	3.2.2.6	Three equally spaced (120°) 3/8-inch cup point set or machine screws shall be used to secure the elevated threshold light assembly mounting base to the support structure.	I	I		4.4.1
232.	3.2.2.6	An adaptable light assembly mounting base mechanical solution shall be such that the light mounting base will have a universal interface that can be interchanged between frangible coupling and frangible coupling/EMT, and LIR mounting structures.	D			4.4.25
233.	3.2.2.6.1	The light assembly mounting base shall interface with a frangible coupling IAW C-6046.	D			4.4.25
234.	3.2.2.6.1	The frangible coupling interface shall consist of a "slip fitter", capping the top of the frangible coupling directly with the light assembly mounting base.	D			4.4.25
235.	3.2.2.6.2	The light assembly mounting base shall allow for the elevated mounting of the assembly on a two (2) inch diameter Electrical Metallic Tubing (EMT) conduit.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
236.	3.2.2.6.2	The EMT interface shall consist of a "slip fitter", capping the top of the EMT directly with the light assembly mounting base.	D			4.4.25
237.	3.2.2.6.2.1	The threshold light assembly mounting base shall interface with the EMT conduit IAW D-6292-7.	D			4.4.25
238.	3.2.2.6.2.2	The steady burning light assembly mounting base shall interface with the EMT conduit IAW D-6292-9.	D			4.4.25
239.	3.2.2.6.2.3	The sequenced flasher light assembly mounting base shall interface with the EMT conduit IAW D-6292-9.	D			4.4.25
240.	3.2.2.6.3	The Low-Impact Resistant (LIR) Structural Mounting requirements shall apply to steady burning and sequenced flasher light assemblies.	N/A			N/A
241.	3.2.2.6.3	The light assembly mounting base shall allow for the elevated mounting light assembly on an LIR structure.	I	I		4.4.1
242.	3.2.2.6.3.1	The steady burning light assembly mounting base in a given light bar shall interface with the LIR by connecting to the T-M Tee-Bar IAW D-6292-13, D-6292-14, and D-6155-2.	D			4.4.25
243.	3.2.2.6.3.1	The sequenced flasher light assembly mounting base shall interface with the LIR by fitting into the LIR tube cap T-1 assembly as specified in D-6292-13 and D-6213-15.	D			4.4.25
244.	3.2.3	All MALSR power and signal interfaces shall use terminal blocks.	I	I		4.4.1
245.	3.2.3	Terminal blocks shall be the enclosed base type terminal blocks using pressure plate type terminal connectors.	I			4.4.1
246.	3.2.3	Terminal blocks shall have ten (10) percent unused terminals, but not less than two (2) extra terminals per terminal block.	I			4.4.1
247.	3.2.3	Power terminal blocks shall have a minimum of six (6) inches clear space at the input and output terminals.	I			4.5.1
248.	3.2.3	Control terminal blocks shall have a minimum of four (4) inches clear space at the input and output terminals.	I			4.5.1
249.	3.2.3.1	All terminal blocks shall have polycarbonate, acrylic, or similar transparent, non-conductive material protective covers.	I	I		4.5.1
250.	3.2.3.1	The protective cover shall have meter probe access holes for all terminals to aid in maintenance.	I	I		4.5.1
251.	3.2.4	An elapsed time meter shall be installed in the control cabinet to indicate the number of hours of operation.	D			4.4.21
252.	3.2.4	The elapsed time meter shall not be re-settable.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
253.	3.2.4	The elapsed time meter shall allow the counter to recycle back to zero once the system has exceeded the maximum measured elapsed time.	I	I		4.4.1
254.	3.2.4	The elapsed time meter shall accumulate elapsed time in hours and tenths of hours over the range of 0 to 99,999.9 hours.	I	I		4.4.1
255.	3.2.4	The accumulated time in the elapsed time meter shall be retained regardless of system power status.	D			4.4.21
256.	3.2.5	The MALSR control cabinet shall contain a locally actuated 120 VAC, Standard Edison Light Bulb Socket.	I	I		4.4.1
257.	3.2.5	The maintenance light shall function even when the MALSR main disconnect circuit breaker is off.	D			4.4.27
258.	3.2.5	Supplemental enclosures shall contain a locally actuated 120 VAC, Standard Edison Light Bulb Socket.	I	I		4.4.1
259.	3.2.5	The supplemental enclosure maintenance light shall be connected to the power provided from the applicable power interface from the MALSR control cabinet.	D			4.4.27
260.	3.2.5	The maintenance light shall be sufficient to illuminate the entire control cabinet or supplemental enclosure for maintenance purposes.	D			4.4.27
261.	3.2.5	The maintenance light shall be protected from damage due to inadvertent impact with standard maintenance tools.	I	I		4.4.1
262.	3.2.5	The maintenance light shall be protected with either a dedicated fuse and activated with a dedicated on/off switch or a single pole circuit breaker.	I	I		4.4.1
263.	3.2.5	A fuse, if used, shall meet the fuse, fuse-holder, and associated hardware requirements as specified in FAA-G-2100g.	D			4.4.17.1
264.	3.2.5	A circuit breaker, if used, shall meet the circuit breakers requirements as specified in FAA-G-2100g.	D			4.4.17.1
265.	3.2.6	The control cabinet shall contain a 120 VAC duplex convenience receptacle.	I	I		4.4.1
266.	3.2.6	The receptacle in the control cabinet shall function even when the MALSR main disconnect circuit breaker is off.	D			4.4.27
267.	3.2.6	Supplemental enclosures shall contain a 120 VAC duplex convenience receptacle.	I	I		4.4.1
268.	3.2.6	The receptacle in the supplemental enclosure shall be connected to the power provided from the applicable power interface within the MALSR control cabinet.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
269.	3.2.6	The receptacle shall be a NRTL listed UL943-93 Ground Fault Circuit Interrupter (GFCI) type electrical outlet, rated for 15 amps minimum, and containing a manual set and reset function.	I	I		4.4.1
270.	3.2.6	The duplex convenience receptacle shall be protected with a dedicated 15-amp fuse housed in an illuminated base.	I	I		4.4.1
271.	3.2.6	The duplex convenience receptacle shall meet the convenience outlet requirements as specified in FAA-G-2100g.	I	I		4.4.1
272.	3.2.6	The receptacle shall be located in an unobstructed area within the control cabinet or supplemental enclosure.	I	I		4.4.1
273.	3.3	Unless otherwise specified, all power circuitry, cabling, wiring, and enclosures shall be approved by a Nationally Recognized Testing Laboratory (NRTL) and meet NFPA 70 requirements.	I	I		4.4.1
274.	3.3.1	The MALSR system shall use solid-state switches for all control and electrical switching components with the exception of circuit breakers.	I	I		4.4.1
275.	3.3.1	MALSR switching control shall be accomplished using microprocessors.	D	D		4.4.32.1 4.4.32.2
276.	3.3.1	Programmable elements shall not be remotely accessible.	T	T	T	Contractor Determined
277.	3.3.1.1	The solid state switching device shall remain active for at least 100 ms following a power interruption to avoid inadvertent system outages	T		T	4.4.32.1
278.	3.3.1.1	The solid state switching devices shall automatically reset on power up, or in the event of power interruption.	D	D		4.4.32.1
279.	3.3.2	All material used in the construction and assembly of components and circuits operating above 6,000 volts, including the insulation of wires that are to be located near or in the sequenced flasher lamp chamber, shall be ozone resistant.	I	I		4.4.1
280.	3.3.3	MALSR cables used in high voltage circuits shall have no more than 1 mA of leakage current when subjected to twice normal circuit voltage plus 1,000 volts at the circuit frequency for one (1) minute.	D			4.4.22
281.	3.3.4	All grounding shall be IAW the National Electric Code and as outlined in FAA-STD-019d.	D	D		4.4.24
282.	3.3.4	All bonding shall be IAW FAA-STD-019d Paragraph 3.14.	D	D		4.4.24
283.	3.3.4	All shielding shall be IAW FAA-STD-019d Paragraph 3.15.	D	D		4.4.20
284.	3.3.5	Equipment nameplates and marking shall be IAW FAA-G-2100g.	I	I		4.4.1
285.	3.3.5	System wiring and marking shall be IAW FAA-G-2100g.	I	I		4.4.1

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
286.	3.3.5	Wiring markings and conductor identification shall be IAW NFPA No. 70, articles 310.11 and 310.12.	I	I		4.4.1
287.	3.3.6	The MALSR system lightning protection shall be IAW the lightning protection system requirements as specified in FAA-STD-019d.	A			N/A
288.	3.3.7	MALSR system cables (power and signal), external to the facility, shall be selected based on the requirements specified in NFPA No. 70, Article 310.	I	I		4.4.1
289.	3.4.1	All equipment used in the MALSR system shall be designed for outdoor installation.	T			4.4.2 thru 4.4.12
290.	3.4.1	The MALSR system shall operate continuously or intermittently under the environmental conditions specified.	T			4.4.2 thru 4.4.12
291.	3.4.1	The system shall be capable of performing satisfactorily under the Common Outdoor Operating Environmental Conditions as specified in FAA-G-2100g except where the requirements in the following subsections differ.	T			4.4.2 thru 4.4.12
292.	3.4.1.1	The system shall exhibit no adverse effects during operation at temperature ranges at all specified climate categories in Table C-1 of MIL-STD-810F.	T		T	4.4.2
293.	3.4.1.2	The system shall exhibit no adverse effects during operation at relative humidity levels over all climate categories defined in Table C-1 of MIL-STD-810F.	T		T	4.4.3
294.	3.4.1.3	The system shall exhibit no adverse effects during operations at an altitude range from -300 feet (-92 meters) to 10,000 feet (3,048 meters) as specified in FAA-G-2100g.	T			4.4.4
295.	3.4.1.4	The system shall exhibit no adverse effects during exposure to wind blown sand and dust particles of 5,700 feet/minute (ft/min) (29 meters/second (m/s)) and 1,750 ft/min (8.9 m/s) respectively.	T			4.4.5
296.	3.4.1.5	The system shall operate under exposure to salt-laden atmosphere with relative humidity as stated in 3.4.1.2.	T			4.4.6
297.	3.4.1.6	The system shall operate under exposure to wind blown rain at rain rates up to 4 inches/hour (in/h) (10 centimeters/hour (cm/h)) and wind velocities up to 40 miles per hour (mph) (18 m/s).	T			4.4.7

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
298.	3.4.1.7	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence. The system shall withstand exposure of external surfaces (including the light windows) to sudden application of cold [0° C to 5° C (32° F to 41° F)] water when the lights reach stable temperatures in the high intensity mode.	T			4.4.8
299.	3.4.1.8	The system shall operate under exposure to sunshine as specified for all climate categories as defined in Table C-1 of MIL-STD-810F.	T			4.4.9
300.	3.4.1.9	Any MALSR component intended to be used in the light plane shall be capable of withstanding vibrations as defined by Procedure 514.5, Figure C-14 in MIL-STD-810F using the parameters presented in TABLE X.	T			4.4.10
301.	3.4.1.10	The system shall operate normally with 0.5-inch radial ice load in winds of 100 mph.	T			4.4.11
302.	3.4.1.11	The system shall operate and exhibit no adverse effects encased in clear ice up to 0.5 in. thick (radial).	T			4.4.11
303.	3.4.1.12	MALSR light sources shall not allow the accumulation of ice on the face of the light source when exposed to an ambient air temperature of -10°C ±2°C and water droplet temperature of 0°C ± 3°C.	T			4.4.12
304.	3.4.2	The system shall not be damaged when stored or transported under conditions delineated in the non-operating conditions as specified in FAA-G-2100g.	A			N/A
305.	3.5.1	The MALSR equipment shall provide Electromagnetic Interference protection as specified in FAA-STD-019d Paragraph 3.15.	T			4.4.20
306.	3.5.1.1	Conducted emission interference levels from the MALSR system shall be no greater than the limits for CE102 as defined in MIL-STD-461. The frequency range shall be 10 kilohertz (kHz) to 10 megahertz (MHz).	T			4.4.20
307.	3.5.1.2	Radiated emission interference levels from the MALSR system shall be no greater than the limits for RE102 as defined in MIL-STD-461 with the exception that the frequency range tested shall be 2 MHz to 10 gigahertz (GHz).	T			4.4.20
308.	3.5.1.2	The RE102 limit shall be IAW Figure RE102-4 for ground applications.	T			4.4.20

REQ NUMBER	Section	Requirement Statement	D Q T	P A T	TYPE	Verification Section
309.	3.5.1.2	Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence. If the emission measurement is made at a distance other than 1 meter, as described in MIL-STD-461, the RE102 limit line of Figure RE102-4 shall be adjusted, over the frequency range measured, for the distance at which the measurement is taken.	T			4.4.20
310.	3.5.1.3	The MALSR system shall meet the Conducted Susceptibility requirements of CS114 specified in MIL-STD-461.	T			4.4.20
311.	3.5.1.3	The frequency range shall be 10 kHz to 400 MHz, and Curve #2 of Figure CS114-1 of MIL-STD-461 shall be used for the limit IAW Table III for AF Ground Equipment.	T			4.4.20
312.	3.5.1.4	The MALSR system shall meet the Radiated Susceptibility requirements of RS103 defined in MIL-STD-461. The frequency range shall be 2 MHz to 10 GHz.	T			4.4.20
313.	3.5.1.4	The electric field intensity shall be IAW the limits for AF ground equipment to Table VII RS103 limits for AF Ground equipment of MIL-STD-461.	T			4.4.20
314.	3.6	The MALSR system, subsystems, and circuitry shall provide ESD protection to reduce the frequency of ESD events and to minimize the effects as outlined in FAA-STD-019d Paragraph 3.16. All electronic circuitry that contain miniaturized or solid-state components shall be considered ESD susceptible.	D	D		4.4.23
315.	3.7	System maintainability shall be in conformance with the maintainability requirements in FAA-G-2100g.	D			4.1.1
316.	3.7	Diagnosis of a MALSR Failure shall be no greater than 0.50 hours.	D			4.1.1
317.	3.7	The Mean-Time-To-Repair (MTTR) requirement shall be no greater than 0.50 hour after determination of the failure.	D			4.1.1
318.	3.7	The Mean Periodic Maintenance Time (MPMT) shall be no greater than 2 hours per calendar quarter, including routine inspection.	D			4.1.1
319.	3.8	Test points shall be provided to allow measurement of performance parameters that confirm proper operation, and identify failed or faulty (performing out of specification) LRU while the system is operational.	D			4.1.1
320.	3.8	Light sources shall be LRUs.	I/D			4.1.1 4.4.1
321.	3.8	All test points and built-in test capabilities shall conform to the maintainability requirements as specified in FAA-G-2100g..	D			4.1.1

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	D Q T	P A T	TYPE	Verification Section
322.	3.9.1	The MALSR system level Mean Time Between Failures (MTBF) shall be greater than 2,500 hours, with an object of 25,000 hours.	D			4.1.2
323.	3.9.2	MALSR structures, enclosures, and components as defined in TABLE I shall be designed for thirty (30) years of use.	A			Contractor Determined
324.	3.10	The system shall meet the personal safety and health requirements specified in Paragraph 3.3.5 of FAA-G-2100g.	A			Contractor Determined
325.	3.11	The MALSR system shall be fail safe as defined in FAA-G-2100g.	D			4.4.19
326.	3.12	The MALSR system shall conform to the thermal design requirements of FAA-G-2100g.	A			Contractor Determined
327.	3.14	Materials that are nutrients for fungi shall not be used	I			4.4.1

**APPENDIX B. MALSRS Requirements Validation Matrix**

<b>REQ NUMBER</b>	<b>Section</b>	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	<b>Parent Requirement(s)</b>	<b>Notes</b>
1.	3.1	The MALSRS system shall be comprised of the main components and associated quantities listed in TABLE I.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.1	
2.	3.1.1.1	The MALSRS system shall interface with semi-flush threshold lights as specified in FAA-E-2968.	AC 150/5300-13, Appendix 2, Section 5.e	
3.	3.1.1.2	The threshold light source shall meet all the following requirements over the environmental operating conditions specified in 3.4.1. The threshold light beam shall exhibit an elliptical pattern defined by the standard ellipse equation:	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	
4.	3.1.1.2.1	$\frac{X^2}{a^2} + \frac{Y^2}{b^2} = 1$ Where X is the horizontal axis and Y is the vertical axis.	ICAO Annex 14, Appendix 2, Figure 2.3	
5.	3.1.1.2.1	The outer bounds of the threshold beam (shown in FIGURE 3) shall be no closer than ±6° from the light unit centerline along the horizontal axis (a = 6°) and shall be no closer than ±4° from the light unit centerline along the vertical axis (b = 4°).	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
6.	3.1.1.2.2	The aviation green output of the threshold lights shall produce three intensity steps that are selected at the control input.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
7.	3.1.1.2.2	Within the threshold beam pattern described in 3.1.1.2.1 and in FIGURE 3, the average intensity (see 4.4.14.1.3) shall be within the required levels for each intensity step as stated in TABLE II	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
8.	3.1.1.2.3	Within the threshold beam pattern described in 3.1.1.2.1 and in FIGURE 3, no measured intensity shall be less than the minimum allowable intensity listed in TABLE III for each intensity step.	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
9.	3.1.1.2.3	Also, within the threshold beam pattern the maximum measured intensity shall be no greater than the maximum allowable intensity listed in TABLE III for each intensity step.	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
10.	3.1.1.2.3	The maximum measured threshold light intensity shall reside within ±3° in all directions from the light unit centerline (see FIGURE 3).	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis

REQ NUMBER	Section	Requirement Statement Note: if there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
11.	3.1.1.2.4	The color of the light emitted from the MALSR threshold lights shall be Aviation Green as specified in SAF-AS25050.	ICAO Annex 14, Appendix 1, Section 2.1.1.c	SAE Color Spec meets ICAO / CIE Specification.
12.	3.1.1.2.5	The threshold light array shall provide an electrical interface to the MALSR control cabinet.	ORPHAN	Not appropriate requirement level for a Performance Specification.
13.	3.1.1.2.5	The threshold light array electrical interface shall consist of all power and control signals necessary to operate the threshold light array in the modes described in Section 3.1.4.1 at a maximum distance of 3,000 ft. from the control cabinet.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.4 AC 150/5300-13, Para 307.a	
14.	3.1.1.2.5	The threshold light source Line Replaceable Unit (LRU) shall have a plug or socket mechanism for maintenance and disconnection of any threshold light.	FAA-G-2100g, Section 3.1.2.4.3	
15.	3.1.1.2.5	The plug or socket mechanism shall be accessible for maintenance IAW 3.7.	FAA-G-2100g, Section 3.1.2.4.3	
16.	3.1.1.2.5	The remaining threshold lights in the array shall operate when any one (1) or more threshold lights source LRUs are disconnected or failed.	ORPHAN	Good Design Practice, Design for Serviceability
17.	3.1.2.1	The MALSR system shall interface with semi-flush steady burning lights as specified in FAA-E-2968.	AC 150/5300-13, Appendix 2, Section 5 e	
18.	3.1.2.2	The steady burning lights shall meet all the following requirements over the environmental operating conditions specified in see 3.4.1.	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	
19.	3.1.2.2.1	The steady burning light beam pattern shall be circular in shape (shown in FIGURE 5).	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
20.	3.1.2.2.1	The outer bounds of the steady burning main beam pattern shall be no closer than $\pm 10^\circ$ .	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
21.	3.1.2.2.1	The steady burning outer-beam pattern, which has lower intensity requirements, shall be no closer than $\pm 14^\circ$ .	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
22.	3.1.2.2.2	The aviation white output of the steady burning light sources shall produce three intensity steps that are selected at the control input.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
23.	3.1.2.2.2	Within the steady burning main-beam pattern described in 3.1.2.2.1, the average intensity (see 4.4.14.2.2) shall be within the required levels as stated in TABLE IV	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis

<b>REQ NUMBER</b>	<b>Section</b>	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	<b>Parent Requirement(s)</b>	<b>Notes</b>
24.	3.1.2.2.3	The maximum measured intensity for the main beam of the steady burning light source on high intensity shall be less than 18,000 candela and reside within $\pm 3^\circ$ from the light unit centerline (see FIGURE 5).	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
25.	3.1.2.2.3	The maximum measured intensity for the outer beam of the steady burning light source on high intensity shall be less than 9,000 candela (see FIGURE 5).	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
26.	3.1.2.2.4	The color of the light emitted from the MALSR steady burning lights shall be Aviation White as specified in SAE-AS25050.	ICAO Annex 14, Appendix 1, Section 2.1.1.e	SAE Color Spec meets ICAO / CIE Specification.
27.	3.1.2.2.5	The steady burning light array shall provide an electrical interface to the MALSR control cabinet.	<b>ORPHAN</b>	
28.	3.1.2.2.5	The electrical interface shall consist of all power and control signals necessary to operate the steady burning light array in the modes described in 3.1.4.1 to a maximum distance of 3,000 feet from the control cabinet.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.4 AC 150/5300-13, Para 307.a	
29.	3.1.2.2.5	The steady burning light source LRU shall have a plug or socket mechanism for maintenance and disconnection of any steady burning light.	FAA-G-2100g, Section 3.1.2.4.3	
30.	3.1.2.2.5	The plug or socket mechanism shall be accessible for maintenance IAW 3.7.	FAA-G-2100g, Section 3.1.2.4.3	
31.	3.1.2.2.5	The remaining steady burning lights in the array shall operate when any one or more steady burning lights source LRUs are disconnected.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
32.	3.1.3	The flashing lights comprising the sequenced flasher array shall flash sequentially, beginning with the sequenced flasher furthest from the threshold, towards the runway threshold at a rate twice per second..	ICAO Annex 14, Section 5.3.4.18	
33.	3.1.3	The sequenced flasher array shall have the ability to be turned off separately from the rest of the MALSR system.	<b>ORPHAN</b>	
34.	3.1.3.1	The MALSR system shall interface with semi-flush sequenced flashing lights (Type II) as specified in FAA-E-2628.	<b>ORPHAN</b>	
35.	3.1.3.2	The sequenced flasher lights shall meet the following requirements over the environmental operating conditions specified in 3.4.1.	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
36.	3.1.3.2.1	<p>The sequenced flasher beam shall exhibit an elliptical pattern defined by the standard ellipse equation:</p> $\frac{X^2}{a^2} + \frac{Y^2}{b^2} = 1$ <p>where X is the horizontal axis and Y is the vertical axis.</p> <p>The outer bounds of the sequenced flasher beam (see FIGURE 7) shall be no closer than ±15° from the light unit centerline along the horizontal axis (a = 15°) and shall be no closer than ±5° from the light unit centerline along the vertical axis (b = 5°).</p> <p>The sequenced flashers shall produce three (3) intensity steps that are selected at the control input.</p>	ICAO Annex 14, Appendix 2, Figure 2.3	
37.	3.1.3.2.1	<p>The average effective intensity (see 4.4.1.4.3.3) for the sequenced flasher at each intensity step shall be within the ranges shown in TABLE V</p> <p>Within the sequenced flasher beam pattern described in 3.1.3.2.1, no measured effective intensity shall be any greater than the maximum or less than the minimum extremes described in TABLE V for each intensity step.</p>	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
38.	3.1.3.2.2	<p>The sequenced flashers shall produce three (3) intensity steps that are selected at the control input.</p>	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
39.	3.1.3.2.2	<p>The average effective intensity (see 4.4.1.4.3.3) for the sequenced flasher at each intensity step shall be within the ranges shown in TABLE V</p> <p>Within the sequenced flasher beam pattern described in 3.1.3.2.1, no measured effective intensity shall be any greater than the maximum or less than the minimum extremes described in TABLE V for each intensity step.</p>	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
40.	3.1.3.2.3	<p>The color of the light emitted from the MALSR sequenced flasher lights shall be Aviation White as specified in SAE-AS25050.</p>	NAS-SS-1000, Vol.3, Section 3.2.1.4.4.2.3	No Engineering Analysis
41.	3.1.3.2.4	<p>The color of the light emitted from the MALSR sequenced flasher lights shall be Aviation White as specified in SAE-AS25050.</p>	ICAO Annex 14, Appendix 1, Section 2.1.1.e	SAE Color Spec meets ICAO / CIE Specification
42.	3.1.3.2.5	<p>The sequenced flasher array shall provide an electrical interface to the MALSR control cabinet.</p>	<b>ORPHAN</b>	Not appropriate requirement level for a Performance Specification.
43.	3.1.3.2.5	<p>The electrical interface shall consist of all power and control signals necessary to operate the sequenced flasher array in the modes described in 3.1.4.1 to a maximum distance of 3,000 feet from the control cabinet.</p>	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.4	Sibling Req. AC 150/5300-13, Para 307.a
44.	3.1.3.2.5	<p>The sequenced flasher light source LRU shall have a plug or socket mechanism for maintenance and disconnection of any sequenced flasher light.</p>	FAA-G-2100g, Section 3.1.4.2.3	
45.	3.1.3.2.5	<p>The plug or socket mechanism shall be accessible for maintenance IAW 3.7.</p>	FAA-G-2100g, Section 3.1.4.2.3	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
46.	3.1.3.2.5	The remaining sequenced flasher lights in the array shall operate when any one or more sequence flasher light LRUs are disconnected or failed.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
47.	3.1.4	The MALSR control cabinet shall include the electrical, mechanical, and electronic components that provide control signals and power distribution to the light field.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2 ICAO Annex 14, Section 5.3.4.18 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
48.	3.1.4	The control cabinet shall provide the circuitry and controls required to fully operate the MALSR system.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2 ICAO Annex 14, Section 5.3.4.18 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
49.	3.1.4	MALSR controls shall provide the capability to perform the following: 1. Actuate the entire light field, 2. Switch between the three intensity levels for the threshold, steady burning, and flasher lights, 3. Turn OFF the flashers without disrupting the operation of the threshold and steady burning lights, 4. Trigger the sequencing of the flasher lights, 5. Turn OFF all lights in the MALSR system, 6. Operate through remote control.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2 ICAO Annex 14, Section 5.3.4.18 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
50.	3.1.4.1	The MALSR control cabinet shall allow both local (manual) and remote operational control of the light field and light intensity levels.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
51.	3.1.4.1.1	The MALSR system shall provide two (2) switches in the control cabinet to perform the following local system control functions: 1. Sequenced Flasher ON/OFF, 2. Light Field Mode Control.	ICAO Annex 14, Section 5.3.4.18 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
52.	3.1.4.1.1	If incandescent lighting is used, the light field mode control switch and the sequenced flasher ON/OFF switches shall be rated for tungsten lamp electrical loads.	FAA-G-2100g, Section 3.3.5.3.1.c	
53.	3.1.4.1.1.1	A single throw switch shall be used to enable/disable the sequenced flasher array.	ICAO Annex 14, Section 5.3.4.18	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
54.	3.1.4.1.1.1	The sequence flasher ON/OFF control switch shall not allow both positions to be selected simultaneously.	FAA-G-2100g, Section 3.3.1.3.9	
55.	3.1.4.1.1.1	The position of the sequence flasher control ON/OFF switch shall have no effect on the operation of the rest of the MALSR light field (threshold and steady burning light arrays).	ICAO Annex 14, Section 5.3.4.18	
56.	3.1.4.1.1.1	Each functional position of the sequenced flasher ON/OFF control switch shall be identified by a selection indicator.	FAA-G-2100g, Section 3.3.1.3.9	
57.	3.1.4.1.1.2	Each functional position of the light field mode control switch shall be identified by a selection indicator.	FAA-G-2100g, Section 3.3.1.3.9 FAA-G-2100g, Section 3.3.3.2.a	
58.	3.1.4.1.1.2	The switch shall provide the following functions: 1. System OFF (Local Control), 2. LOW Intensity (Local Control), 3. MEDIUM Intensity (Local Control), 4. HIGH Intensity (Local Control), 5. REMOTE control.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
59.	3.1.4.1.1.2	The light field mode control switch shall not allow multiple positions to be selected simultaneously.	FAA-G-2100g, Section 3.3.1.3.9	
60.	3.1.4.1.2	When the light field mode control switch (see 3.1.4.1.1.2) is set to the "REMOTE" position, the MALSR system shall be externally controlled as described in 3.1.4.8.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
61.	3.1.4.1.3	When operational, all lights in the MALSR system (threshold, steady burning, and sequenced flasher) shall function on one of three intensity settings: LOW, MEDIUM, and HIGH.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
62.	3.1.4.1.3	Regardless of control method, the entire MALSR light field shall be set to the same intensity level based on the intensity setting.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
63.	3.1.4.1.3	Changing the intensity step to a different setting shall change the intensity of all lights in the MALSR light field.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
64.	3.1.4.1.3	All intensity step changes (including to/from off conditions) shall be completed within two (2) seconds of the applied control signal.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2	
65.	3.1.4.1.4	The control switches described in 3.1.4.1.1.1 and 3.1.4.1.1.2 shall produce the MALSR light field functionality as described in TABLE VI.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.2	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
66.	3.1.4.1.5	The control switches described in 3.1.4.1.1.1 and 3.1.4.1.1.2 shall produce the MALS-R intensity level switching sequence and minimum dwell time as described in TABLE VII.	<b>ORPHAN</b>	Comment to add requirement originated in the Alaska region and is identified in the Notes in Sec. 6.
67.	3.1.4.2	Power for all subsystems within the MALS-R, including the light field, shall be derived from the facility power source specified below.	FAA-G-2100g, Section 3.1.1.1.b	
68.	3.1.4.2.1	The MALS-R system power demand, with the sequenced flashers on and the system on high intensity, shall be less than 14 kilowatts (kW) with an objective of 2.8 kW/h.	<b>ORPHAN</b>	14 KW/Hr is the current power consumption.
69.	3.1.4.2.2	The facility power interface for the MALS-R system shall be four wire, 120/240 volts, 60 Hertz (Hz), single phase, alternating current consisting of L1, L2, Neutral, and equipment grounding conductor.	FAA-G-2100g, Section 3.1.1.b	
70.	3.1.4.2.2	The MALS-R system shall not experience performance degradations with input power voltage variations as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.7.a	
71.	3.1.4.2.3	The MALS-R system shall not be damaged or experience performance degradations with steady state and momentary deviations in input power frequency as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.7.c	
72.	3.1.4.2.4	Load balancing shall meet the electrical load balance requirements specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.4	
73.	3.1.4.2.5	The MALS-R system shall limit the maximum surge current to less than four (4) times the full load operating current.	<b>ORPHAN</b>	
74.	3.1.4.2.5	The addition of line reactors or increased transformer leakage inductance within the MALS-R system shall have no effect on the overall efficiency, nor result in a system output impedance exceeding two (2) percent of the system load.	NFPA Article 215 Feeders	
75.	3.1.4.2.6	The MALS-R system harmonics shall meet the input power harmonic requirements specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.5	
76.	3.1.4.2.6	The MALS-R system shall not experience performance degradations caused by input power harmonic distortions as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.7.d	
77.	3.1.4.2.7	The MALS-R system power factor shall meet the power factor requirements as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.3.1	
78.	3.1.4.3	The MALS-R control cabinet shall contain the circuit termination point for the input power interface from a distribution panel.	FAA-G-2100g, Section 3.1.1.b	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
79.	3.1.4.3	A sub-panel within the control cabinet shall be used to house the power termination point, the main disconnect circuit breaker, subsystem disconnect circuit breakers, neutral bus, grounding bus, and all MALSR power distribution fuses.	FAA-G-2100g, Section 6.2.10	
80.	3.1.4.3	The MALSR control cabinet shall provide a power distribution system to the threshold, steady burning, and sequenced flasher arrays in the configuration outlined in the MALSR installation drawings D-6292-3.	FAA-G-2100g, Section 6.2.10	
81.	3.1.4.3.1	The disconnect circuit breakers shall be selected IAW NFPA 70 and FAA-G-2100g.	FAA-G-2100g, Section 3.3.1.3.2	
82.	3.1.4.3.1	The disconnect circuit breakers shall meet the circuit overload protection requirements in Paragraph 3.1.1.6 of FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.6	
83.	3.1.4.3.1	The disconnect circuit breaker shall be sufficient to operate the MALSR subsystems in all normal operating modes.	FAA-G-2100g, Section 3.1.1.7.a	
84.	3.1.4.3.1	Solid-state switches shall not be used as disconnect circuit breaker.	FAA-G-2100g, Section 3.1.1.1.b.1 FAA-G-2100g, Section 3.3.1.3.2	
85.	3.1.4.3.1.1	A main power disconnect circuit breaker shall be used to control the application of power within the MALSR system.	FAA-G-2100g, Section 3.1.1.1.b.1	
86.	3.1.4.3.1.1	The MALSR system shall have a main disconnect circuit breaker that provides circuit protection and power disconnect capabilities for the entire system, except as noted in 3.2.5 and 3.2.6.	FAA-G-2100g, Section 3.1.1.1.b.1	
87.	3.1.4.3.1.2	Subsystem disconnect circuit breakers shall be provided to control the application of power and provide protection to the threshold light array, the steady burning light array, the sequenced flasher light array, the remote control terminal block, and the sequenced flasher control circuitry.	FAA-G-2100g, Section 6.2.10	
88.	3.1.4.3.1.2	When the MALSR system is de-energized through the main power disconnect breaker, regardless of operating mode (local or remote), the input side of all subsystem disconnect circuit breakers shall be open circuited.	FAA-G-2100g, Section 3.1.1.1.b.1	
89.	3.1.4.3.2.1	Power interfaces within the MALSR system shall be protected from any conducted power line surges as specified in FAA-STD-019d.	FAA-STD-019D, Section 3.5	
90.	3.1.4.3.2.2	The power interfaces within the MALSR system shall provide conducted line transient protection as specified in FAA-STD-019d.	FAA-STD-019D, Section 3.5	

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91.	3.1.4.3.2.2	The system shall be operational when exposed to a combination waveform consisting of a 1.2/50 microsecond ( $\mu$ s) voltage spike at 10 kilovolts (kV) and an 8/20 $\mu$ s current spike at 10 kiloamps (kA).	Current Spike Req.: FAA-STD-019D, Section 3.5 Voltage Spike Req.: ORPHAN	Sibling Req. IEEE C62.45-2002
92.	3.1.4.3.2.3	The MALSRS system performance shall not be damaged by facility power input voltage conditions outside those specified in 3.1.4.2.2.	FAA-G-2100g, Section 3.1.1.7.a	
93.	3.1.4.3.2.3	The 120/240 volts (V) circuits within the MALSRS system shall maintain normal operation during voltage/time events as defined by the "FAA Input Power Tolerance Envelope" presented in Appendix 1 of FAA-G-2100g.	FAA-G-2100g, Appendix 1	
94.	3.1.4.3.2.4	The MALSRS system performance shall not be damaged by facility power outage conditions.	FAA-G-2100g, Section 3.2.4.e	
95.	3.1.4.3.2.4	When facility power is restored following an outage, the MALSRS system, when in local control as outlined in 3.1.4.1.1, shall return to the same state of service as before the power outage.	FAA-G-2100g, Section 3.2.4.e	
96.	3.1.4.4	The MALSRS system shall not be damaged by any interface disturbance at any of the following internal and external interfaces within the MALSRS system unless otherwise indicated: remote control terminal block, threshold light array, steady burning array, and sequenced flasher light array interfaces.	FAA-STD-019D, Section 3.6	
97.	3.1.4.4.1	The MALSRS signal interfaces shall provide conducted line transient protection as specified in FAA-STD-019d.	FAA-STD-019D, Section 3.6	
98.	3.1.4.5	The MALSRS control cabinet shall provide power necessary to operate the threshold light array as described in 3.1.4.3.2 and 3.1.4.1.5.	FAA-G-2100g, Section 6.2.10	
99.	3.1.4.5	The MALSRS control cabinet shall provide control signals necessary to operate the threshold light array in the manual and remote modes as described in 3.1.4.1.1 and 3.1.4.8.5.	FAA-G-2100g, Section 6.2.10	
100.	3.1.4.6	The MALSRS control cabinet shall provide power necessary to operate the steady burning light array as described in 3.1.4.3.2 and 3.1.4.1.5.	FAA-G-2100g, Section 6.2.10	
101.	3.1.4.6	The MALSRS control cabinet shall provide control signals necessary to operate the steady burning light array in the manual and remote modes as described in 3.1.4.1.1 and 3.1.4.8.5.	FAA-G-2100g, Section 6.2.10	
102.	3.1.4.7	The MALSRS control cabinet shall provide power necessary to operate the sequenced flasher light array as described in 3.1.4.3.2 and 3.1.4.1.5.	FAA-G-2100g, Section 6.2.10	

<b>REQ NUMBER</b>	<b>Section</b>	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	<b>Parent Requirement(s)</b>	<b>Notes</b>
103.	3.1.4.7	The MALSRR control cabinet shall provide control signals necessary to operate the sequenced flasher light array in the manual and remote modes as described in 3.1.4.1.1 and 3.1.4.8.5.	FAA-G-2100g, Section 6.2.10	
104.	3.1.4.8.1	Termination of the remote control signal lines shall be provided in a remote control terminal block.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
105.	3.1.4.8.1	The remote control terminal block shall meet the requirements in 3.2.3.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	
106.	3.1.4.8.2	The remote control terminal block shall provide an interface for eight (8) signals as described in TABLE VIII.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
107.	3.1.4.8.2	When the light field mode control switch is in the REMOTE control position, the MALSRR shall be controlled through signals received through the Remote Control Terminal Block.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
108.	3.1.4.8.3	The maximum MALSRR current loading for any single remote control input Terminal (3, 4, 5, 7) shall be 500 milliamps (mA).	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
109.	3.1.4.8.4	When individually or when any combination of Terminals 3, 4, 5, 7 are set to 120 VAC, when referenced to ground, the terminals shall be considered ON (energized).	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
110.	3.1.4.8.4	When individually or when any combination of terminals 3, 4, 5, 7 are electrically unconnected, the terminals shall be considered OFF (de-energized).	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
111.	3.1.4.8.4.1	Remote Control Terminal 1 shall be internally connected to 120 VAC power.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3

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112.	3.1.4.8.4.2	When the Terminal 1, 120 VAC, signal is present on Terminals 3 through 5 in one of the mapped combinations shown in TABLE IX, it shall be interpreted by the MALSR system as an active or enable condition for the steady burning and threshold lights to operate on that intensity level.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
113.	3.1.4.8.4.3	When the 120 VAC signal is present on Terminal 7 as shown in TABLE IX, it shall be interpreted by the MALSR system as an active or enable condition for the sequenced flashers to operate on the intensity level mapped by Terminals 3 through 5.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
114.	3.1.4.8.4.4	Terminal 8 shall be connected to the neutral bus internal to the MALSR system.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
115.	3.14.8.5	The remote control signals described in 3.1.4.8.4 through 3.1.4.8.4.4 shall provide the following MALSR system functionality as described in TABLE IX.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2 NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.2.1	Sibling Req. FAA-E-2663, Section 3.9.3
116.	3.1.4.9.1	The flasher sequence shall consist of eight (8) flasher triggers beginning with the flasher farthest from the runway threshold and proceeding to the flasher closest to the runway threshold.	ICAO Annex 14, Section 5.3.4.18	
117.	3.1.4.9.1	The flasher sequence shall be triggered 120 times a minute regardless of the number of flasher units present.	ICAO Annex 14, Section 5.3.4.18	
118.	3.1.4.9.1	The triggering of any flasher sequence shall coincide with the first flasher trigger.	ICAO Annex 14, Section 5.3.4.18	
119.	3.1.4.9.1	The time between the start of consecutive flash sequences shall be 0.5 ± 0.015 s.	ICAO Annex 14, Section 5.3.4.18	
120.	3.1.4.9.2	MALSR flasher trigger and timer circuits shall be designed to accommodate a maximum of eight flasher light sources (units) in the array.	ICAO Annex 14, Section 5.3.4.18	
121.	3.1.4.9.2	For the five (5) sequenced flasher configuration, trigger number 6, 7, and 8 shall be left unconnected.	ICAO Annex 14, Section 5.3.4.18	
122.	3.1.4.9.3	The flash duration shall be no greater than 5.5 milliseconds (ms) and no less than 0.25 ms.	ORPHAN	
123.	3.1.4.9.4	The interval between flashes of adjacent units shall be 33.3 ± 0.1 ms.	ORPHAN	
124.	3.1.4.9.5	The failure of one or more flashers in the array shall have no effect on the operation of the remaining units.	ICAO Annex 14, Section 5.3.4.18	

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125.	3.1.4.9.6	A flasher unit shall not fire without a flasher trigger.	ICAO Annex 14, Section 5.3.4.18	
126.	3.1.4.9.7	Flasher unit misfiring shall be less than 1 percent over 60 minutes with no misfires occurring on adjacent flasher units consecutively.	ORPHAN	
127.	3.1.4.10	The MALSR Control Cabinet shall be capable of displaying a visual indication of all current operational commands received manually (locally) or remotely.	ORPHAN	Good Design Practice, Design for Serviceability
128.	3.1.4.10.1	The System Status / Diagnostic Display shall be capable of displaying the current operating mode to include: System On, System Off, Low Intensity, Medium Intensity, High Intensity, Sequenced Flashers On, and Sequenced Flashers Off.	ORPHAN	Good Design Practice, Design for Serviceability
129.	3.1.4.10.2	The System Status / Diagnostic Display shall be capable of displaying all MALSR diagnosed faults	ORPHAN	Good Design Practice, Design for Serviceability
130.	3.1.4.10.3	The System Status / Diagnostic Display shall be capable of displaying the flasher sequence rate, individual flasher trigger pulses, the flash interval, and out-of-specification warnings.	ORPHAN	Good Design Practice, Design for Serviceability
131.	3.1.5.1	A single alignment device shall be provided to aim threshold, steady burning, and sequenced flashing lights installed in all possible mounting configurations detailed in 3.2.2.6.1, 3.2.2.6.2, and 3.2.2.6.3.	FAA Order 6850.2A, Section 206	
132.	3.1.5.1.1	The alignment device shall indicate aiming angle on a scale calibrated in at least 1° increments and be accurate to within ±0.5° of the actual angle with the device attached.	FAA Order 6850.2A, Section 206 FAA Order 6850.2A, Table 2-2	No Engineering Analysis. Current design does not meet the aiming accuracy in Table 2-2; however, the accepted aiming procedure (TI 6850.89) does not spec out a need for greater aiming accuracy.

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133.	3.1.5.1.1	The alignment device shall provide light source vertical alignment to within $\pm 1^\circ$ of the desired aiming angle following the removal of the alignment device.	FAA Order 6850.2A, Section 206 FAA Order 6850.2A, Table 2-2	No Engineering Analysis. Current design does not meet the aiming accuracy in Table 2-2; however, the accepted aiming procedure (TI 6850.89) does not spec out a need for greater aiming accuracy.
134.	3.1.5.1.1	The alignment device shall permit field aiming of the light beam at any angle from $0^\circ$ to $+25^\circ$ above the horizontal.	FAA Order 6850.2A, Section 206	No Engineering Analysis
135.	3.1.5.1.2	The alignment device shall allow the operator to aim lights without the need for tools.	FAA Order 6850.2A, Section 206	
136.	3.1.5.1.2	The alignment device shall not require the disassembly of any part of the light assembly or removal of the light source to complete the aiming activity.	FAA Order 6850.2A, Section 206	
137.	3.1.5.1.2	The alignment device shall be capable of aiming threshold and steady burning lights when mounted on low impact resistant structures that conform to FAA-E-2604 or FAA-E-2702.	FAA Order 6850.2A, Section 206	
138.	3.1.5.1.2	The alignment device shall retain its reading when the tower is lowered.	FAA Order 6850.2A, Section 206	
139.	3.1.5.1.2	Starting with the structure in the elevated position, the alignment device shall permit aiming from the ground after lowering the structure parallel to the runway centerline a maximum of two (2) times (including installation and removal of the alignment device).	FAA Order 6850.2A, Section 206	
140.	3.1.5.1.3	The alignment device shall weigh no greater than two (2) lbs.	FAA Order 6850.2A, Section 206	
141.	3.1.5.1.3	The alignment device shall be constructed of non-corrosive material.	FAA Order 6850.2A, Section 206	
142.	3.1.5.1.3	The alignment device shall have no loose parts.	FAA Order 6850.2A, Section 206	
143.	3.1.5.1.3	Self-retaining fastening devices shall be used to assemble any parts.	FAA Order 6850.2A, Section 206	
144.	3.1.5.1.3	The alignment device shall provide means to retain an alignment reading when subject to movement or transport.	FAA Order 6850.2A, Section 206	
145.	3.1.5.1.3	If the alignment device is mechanical, it shall have an enclosed dial and stop brake to hold the reading.	FAA Order 6850.2A, Section 206	

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146.	3.1.5.1.3	If the alignment device is electrical, it shall be battery powered.	FAA Order 6850.2A, Section 206	
147.	3.1.5.1.4	The alignment device shall operate in the environmental conditions specified in 3.4.1 with the exception of 3.4.1.10 through 3.4.1.11.	FAA Order 6850.2A, Section 206 NAS-SS-1000, Vol.1, Section 3.2.5	
148.	3.1.5.1.4	The alignment device shall operate in winds of 25 knots gusting to 35 knots.	FAA Order 6850.2A, Section 206 NAS-SS-1000, Vol.1, Section 3.2.5	
149.	3.1.5.1.5	The alignment device stored in its transport case shall be transportable by one person.	NAS-SS-1000, Vol. 1, 3.2.6.1	
150.	3.1.5.1.5	The alignment device transport case shall protect the alignment device from damage when subjected to drops from a height of four (4) feet at any angle on any axis.	NAS-SS-1000, Vol. 1, 3.2.6.1	
151.	3.1.5.2.1	The MALSR system shall have a sequenced flasher test interface at the supplemental enclosure for each sequenced flasher.	NAS-SS-1000, Vol. 1, Section 3.5.4	
152.	3.1.5.2.1	The interface shall provide for a sequenced flasher test unit to verify correct operation of the MALSR flasher control parameters as described in 3.1.4.9.	NAS-SS-1000, Vol. 1, Section 3.5.4	
153.	3.1.5.2.2	The interface shall allow for identification of failures and out of specification performance of sequenced flasher units and control circuitry to the LRU level.	NAS-SS-1000, Vol. 1, Section 3.5.4	
154.	3.1.5.2.2	The sequenced flasher test unit shall identify the following: 1. Input voltage and current of the sequenced flasher unit 2. Flash Rate 3. Anode voltage for capacitive discharge xenon flash tubes or the lamp input voltage and current for other light sources. 4. Bleed down time for capacitive discharge xenon flash tubes 5. Interlock switch status 6. Trigger the Sequence Flasher	NAS-SS-1000, Vol. 1, Section 3.5.4	
155.	3.1.5.2.3	The sequenced flasher test shall provide all measurement functions in two (2) or less operator actions.	NAS-SS-1000, Vol. 1, Section 3.5.4	
156.	3.1.5.2.3	LRU fault isolation shall be accomplished by a single test.	NAS-SS-1000, Vol. 1, Section 3.5.4	
157.	3.1.5.2.3	The sequenced flasher test unit display shall be visible under all ambient lighting conditions.	NAS-SS-1000, Vol. 1, Section 3.5.4	
158.	3.1.5.2.3	Linear electrical data and out of tolerance values shall be displayed in engineering units.	NAS-SS-1000, Vol. 1, Section 3.5.4	
159.	3.1.5.2.3	LRU information shall be displayed in English language formats without the use of special codes or look-up tables	NAS-SS-1000, Vol. 1, Section 3.5.4	

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160.	3.1.5.2.3	The sequenced flasher test unit shall have the capability to trigger a sequenced flasher.	NAS-SS-1000, Vol. 1, Section 3.5.4	
161.	3.1.5.2.4	The sequenced flasher test unit shall operate in the environmental conditions specified in 3.3 with the exception of 3.4.1.10 through 3.4.1.11.	NAS-SS-1000, Vol.1, Section 3.2.5 NAS-SS-1000, Vol. 1, Section 3.5.4	
162.	3.1.5.2.4	The sequenced flasher tester unit shall operate in winds of 25 knots gusting to 35 knots.	NAS-SS-1000, Vol.1, Section 3.2.5 NAS-SS-1000, Vol. 1, Section 3.5.4	
163.	3.1.5.2.5	The sequenced flasher test unit shall be portable.	NAS-SS-1000, Vol.1, Section 3.2.5 NAS-SS-1000, Vol. 1, Section 3.5.4	
164.	3.1.5.2.5	The sequenced flasher test unit transport case shall protect the sequenced flasher tester from damage when subjected to drops from a height of 4 feet at any angle on any axis.	NAS-SS-1000, Vol. 1, 3.2.6.1	
165.	3.2	Hardware components selected/designed for use in the MALSR system shall meet the Materials, Processes, and Parts requirements as specified in FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.3.1	
166.	3.2	No moving parts (i.e., relays, contactors, fans, etc.) shall be incorporated in the MALSR system.	<b>ORPHAN</b>	Eliminates problem with the contacts pitting on the switches.
167.	3.2.1.1	The MALSR system shall contain a control cabinet.	NAS-SS-1000, Vol. 3 Section 3.2.1.4.4.1.1	
168.	3.2.1.1.1	The control cabinet shall provide an internal ground lug located in the inside bottom edge of the cabinet and electrically connected (not isolated) from the control cabinet.	FAA-STD-019D, Section 3.13.1	
169.	3.2.1.1.1	The ground lug shall be compatible with the enclosure type.	FAA-STD-019D, Section 3.14.2.3	
170.	3.2.1.1.1	The ground lug shall accept the gauge of the grounding conductor which shall be of the same gauge of the phase conductors as required for the design of the system based on the NEC and FAA-STD-019D.	FAA-STD-019D, Section 3.12.3	
171.	3.2.1.1.1	If multiple grounding conductors are used, the ground lug shall be a multiple conductor type lug.	<b>ORPHAN</b>	Req. may be in the NEC document
172.	3.2.1.1.2	The control cabinet shall not bend or distort under normal commercially accepted methods of shipping, handling, storage, and installation.	<b>ORPHAN</b>	Req. not needed since we specify NEMA 4x Enclosures

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
173.	3.2.1.1.3	The control cabinet shall be no greater than 40 inches tall, 29 inches wide and 16 inches deep.	ORPHAN	W. Findlay (AOS-NAVAID Engineering) revised dimensions. Original dimension were pulled from FAA Drawing D-6292-19
174.	3.2.1.1.4	The control cabinet shall weigh no greater than 85 pounds	ORPHAN	Weight Constraint pulled from "Quick Look Report for NBP MALSR Solid State Switcher Evaluation" from NAV/AID Engineering dtd 10/14/2004
175.	3.2.1.1.5	Materials used for the control cabinet shall meet the requirements of FAA-G-2100g Paragraph 3.3.1.1.	NAS-SS-1000, Vol. 1, Section 3.3.1 FAA-G-2100g, Section 3.3.1.1	
176.	3.2.1.1.5	NEMA 4X type enclosures, as defined in the NEMA 250 standard, shall be used even if the system element is located inside of a shelter.	FAA-G-2100g, Section 3.1.2.4.4.b	
177.	3.2.1.1.5	The control cabinet shall operate under the environmental conditions specified in Paragraph 3.4.1.	NAS-SS-1000, Vol. 1, Section 3.2.5	
178.	3.2.1.1.6	The control cabinet shall provide integral vertical mounting provisions external to the enclosure so that it can be mounted inside a shelter (see D-6292-19) and on an external frame (see D-6292-5).	FAA Order 6850.2A, Section 209.a	
179.	3.2.1.1.6	External mounting studs/bolts shall not protrude through the internal surface of the control cabinet wall.	ORPHAN	
180.	3.2.1.1.7	Control cabinet subassemblies shall be mounted on a panel attached to the rear interior cabinet wall using studs.	ORPHAN	Not appropriate requirement level for a Performance Specification.
181.	3.2.1.1.7	All subassemblies shall be attached to the panel using fasteners as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.3.1.4.3	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
182.	3.2.1.1.7	Internal mounting studs shall not protrude through the external surface of the control cabinet wall.	ORPHAN	
183.	3.2.1.1.8	The control cabinet door shall be hinged vertically, opening to the right side when the cabinet is mounted in a vertical, upright position.	ORPHAN	
184.	3.2.1.1.8	A control cabinet doorstop shall be provided for locking the door in a 120° (±15°) open position.	FAA-G-2100g, Section 3.1.2.4.4.j	
185.	3.2.1.1.8	Electrical components and cables shall not be attached to the control cabinet door.	ORPHAN	
186.	3.2.1.1.8	Continuous gaskets, commensurate with specified environmental operating conditions (see 3.3) and electromagnetic interference (see 3.5), shall be used to seal the control cabinet with the door in the closed position.	NAS-SS-1000, Vol. 1, Section 3.2.5 NAS-SS-1000, Vol.1, Section 3.3.2	
187.	3.2.1.1.8	Grounding of the control cabinet door shall be in accordance with the hinged panels and doors requirements as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.3.5.1.2	
188.	3.2.1.1.9	The control cabinet door handle lever shall include provisions for a security padlock.	ORPHAN	Good Design Practice. Physical Security
189.	3.2.1.1.9	The padlock holes in the control cabinet door handle shall be aligned to accommodate a six (6) inch long by 3/8-inch diameter horizontal rod when the door handle is in the locked position and the cabinet is oriented in a vertical upright position.	ORPHAN	Good Design Practice. Physical Security
190.	3.2.1.1.9	The control cabinet door handle shall be within ±22° of vertical when in the locked position.	ORPHAN	Good Design Practice. Physical Security
191.	3.2.1.1.9	When closed and locked, the control cabinet door shall remain closed and locked regardless of the installed padlock shaft diameter.	ORPHAN	Good Design Practice. Physical Security
192.	3.2.1.1.10	The control cabinet shall contain a sub-panel to house the facility power interface circuitry as specified in 3.1.4.1.5 and local control switches as specified in 3.1.4.1.1.	FAA-G-2100g, Section 3.1.2.4	
193.	3.2.1.1.10	The control cabinet power sub-panel shall be hinged.	FAA-G-2100g, Section 3.1.2.4	
194.	3.2.1.1.10	The MALSRS Light Mode Control Switch, Sequenced Flasher ON/OFF Switch, all Circuit Disconnect Breakers, and all fuses shall be accessible when the control cabinet power sub-panel is in the closed position.	FAA-G-2100g, Section 3.1.2.4	

<b>REQ NUMBER</b>	<b>Section</b>	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	<b>Parent Requirement(s)</b>	<b>Notes</b>
195.	3.2.1.1.10	The control cabinet power sub-panel shall be held closed by a minimum of two (2) captive screws.	FAA-G-2100g, Section 3.1.2.4	
196.	3.2.1.1.11	The component layout within the control cabinet shall provide adequate clearance for field installation and maintenance.	FAA-G-2100g, Section 3.1.2.4	
197.	3.2.1.1.11	Power and control signal terminal blocks shall be located near cable entry locations.	FAA-G-2100g, Section 3.1.2.4	
198.	3.2.1.1.11	The MALSR control cabinet shall meet accessibility requirements as specified in FAA-G-2100g..	FAA-G-2100g, Section 3.1.2.4.1 FAA-G-2100g, Section 3.1.2.4.2 FAA-G-2100g, Section 3.1.2.4.3	
199.	3.2.1.1.12	The inside of the control cabinet door shall facilitate the attachment of a laminated detailed electrical interconnection schematic of the control cabinet.	FAA-G-2100g, Section 3.1.2.4.1.a	
200.	3.2.1.2	The quantity of supplemental enclosures shall be no greater than the number of sequenced flasher units.	<b>ORPHAN</b>	
201.	3.2.1.2.1	Supplemental enclosures shall meet the ground lug requirements specified in 3.2.1.1.1.	FAA-STD-019D, Section 3.13.1	
202.	3.2.1.2.2	Supplemental enclosures shall meet the cabinet construction requirements in 3.2.1.1.2.	<b>ORPHAN</b>	
203.	3.2.1.2.3	Supplemental enclosures shall meet the cabinet materials requirements in 3.2.1.1.5.	FAA-G-2100g, Section 3.1.2.4.4.b NAS-SS-1000, Vol. 1, Section 3.2.5	
204.	3.2.1.2.4	Supplemental enclosures shall provide integral vertical mounting provisions external to the enclosure.	FAA Order 6850.2A, Section 209.a	
205.	3.2.1.2.4	If the supplemental enclosure is to be used within the runway safety area or runway object free area, mounting provisions shall include two 2-inch threaded fittings on the bottom surface together with mounting lugs located on the rear surface.	AC 150/5300-13, Section 305.a.4	
206.	3.2.1.2.4	A third fitting shall be furnished on the bottom surface of the supplemental enclosure to accommodate a 0.75 inch flexible conduit.	AC 150/5300-13, Section 305.a.4	
207.	3.2.1.2.4	External mounting studs on the supplemental enclosure shall not protrude through the internal surface of the enclosure wall.	<b>ORPHAN</b>	
208.	3.2.1.2.5	Internal mounting studs on the supplemental enclosure shall not protrude through the external surface of the enclosure wall.	<b>ORPHAN</b>	
209.	3.2.1.2.6	The supplemental enclosure door shall be hinged vertically, opening to the right side when the cabinet is mounted in a vertical, upright position.	<b>ORPHAN</b>	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
210.	3.2.1.2.6	Electrical components and cables shall not be attached to the supplemental enclosure door.	ORPHAN	
211.	3.2.1.2.6	Continuous gaskets, commensurate with specified environmental operating conditions (see 3.3) and electromagnetic interference (see 3.5), shall be used to seal the supplemental enclosure with the door in the closed position.	NAS-SS-1000, Vol. 1, Section 3.2.5 NAS-SS-1000, Vol.1, Section 3.3.2	
212.	3.2.1.2.6	Grounding of a supplemental enclosure door shall be the hinged panels and doors requirements as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.3.5.1.2	
213.	3.2.1.2.7	Supplemental enclosures shall meet the component layout requirements in 3.2.1.1.1.1.	FAA-G-2100g, Section 3.1.2.4	
214.	3.2.1.2.8	Supplemental enclosures shall meet the wiring diagram attachment requirements in 3.2.1.1.1.2.	FAA-G-2100g, Section 3.1.2.4.1.a	
215.	3.2.2	Unless otherwise specified, the following light source requirements shall apply to each light assembly in the threshold light array, steady burning light array, and the sequenced flasher array.	ORPHAN	
216.	3.2.2.1	The light assembly shall consist of a light source, light holder, and a light-mounting base.	ORPHAN	Not Appropriate Requirement Level for a Performance Specification.
217.	3.2.2.1	Each above light assembly shall contain the hardware necessary to mount one (1) light.	FAA Order 6850.2A, Section 200.d	
218.	3.2.2.1	The light assembly shall be painted Aviation Orange in accordance with FED-STD-595.	ICAO Annex 14, Section 6.2.5	
219.	3.2.2.2	The complete threshold light assembly shall weigh no more than 6.5 pounds (lbs).	ORPHAN	
220.	3.2.2.3	The complete steady burning light assembly shall weigh no more than 1.5 lbs when install on a frangible coupling or EMT conduit.	ORPHAN	
221.	3.2.2.3	The complete steady burning light assembly shall weigh no more than 1.0 lb when installed on a LIR structure Tee-Bar.	ORPHAN	No Engineering Analysis.  Sibling Req. FAA-E-2702A, Section 4.2.2 Specifies a 6lbs Light Source

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
222.	3.2.2.4	The complete sequenced flasher assembly shall weigh no more than 6.5 lbs.	ORPHAN	No Engineering Analysis. Sibling Req. FAA-E-2702A, Section 4.2.2 specifies a 6 lbs light source.
223.	3.2.2.5	The light assembly shall provide continuous vertical adjustment of the light beam axis from 0° horizontal to 25° above horizontal.	FAA Order 6850.2A, Section 206 FAA Order 6850.2A, Table 2-2	No Engineering Analysis.
224.	3.2.2.5	The light assembly shall permit vertical alignment of the light beam to any vertical angle within $\pm 0.5^\circ$ .	FAA Order 6850.2A, Section 206 FAA Order 6850.2A, Table 2-2	No Engineering Analysis. Current design does not meet the aiming accuracy in Table 2-2; however, the accepted aiming procedure (TI 6850.89) does not spec out a need for greater aiming accuracy.
225.	3.2.2.5	A locking mechanism shall be provided to securely lock each light assembly in its set position.	FAA Order 6850.2A, Section 206	
226.	3.2.2.5	The light shall operate over the entire vertical alignment range.	FAA Order 6850.2A, Section 206	
227.	3.2.2.5	The light assembly locking mechanism shall keep the light aligned while exposed to the wind and ice loading requirements specified in 3.4.1.10 and 3.4.1.11.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.2.5	
228.	3.2.2.6	The light assembly mounting base shall provide rigid mechanical support for one (1) light source holder.	ORPHAN	Not appropriate requirement level for a Performance Specification.
229.	3.2.2.6	The light assembly mounting base shall have an internal wire-way that provides an interface to all signal and power wires from the bottom of the light mounting base.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3 FAA Order 6850.2A, Section 200.d	

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230.	3.2.2.6	Three equally spaced (120°) 3/8-inch cup point set or machine screws shall be used to secure the elevated threshold light assembly mounting base to the support structure.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
231.	3.2.2.6	An adaptable light assembly mounting base mechanical solution shall be such that the light mounting base will have a universal interface that can be interchanged between frangible coupling and frangible coupling/EMT, and LIR mounting structures.	<b>ORPHAN</b>	Good Design Practice. Reduces Part Count.
232.	3.2.2.6.1	The light assembly mounting base shall interface with a frangible coupling IAW C-6046.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
233.	3.2.2.6.1	The frangible coupling interface shall consist of a "slip fitter", capping the top of the frangible coupling directly with the light assembly mounting base.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
234.	3.2.2.6.2	The light assembly mounting base shall also for the elevated mounting of the assembly on a two (2) inch diameter Electrical Metallic Tubing (EMT) conduit.	FAA Order 6850.2A, Section 201.a	
235.	3.2.2.6.2	The EMT interface shall consist of a "slip fitter", capping the top of the EMT directly with the light assembly mounting base.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
236.	3.2.2.6.2.1	The threshold light assembly mounting base shall interface with the EMT conduit IAW D-6292-7.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
237.	3.2.2.6.2.2	The steady burning light assembly mounting base shall interface with the EMT conduit IAW D-6292-9.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
238.	3.2.2.6.2.3	The sequenced flasher light assembly mounting base shall interface with the EMT conduit IAW D-6292-9.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
239.	3.2.2.6.3	The Los-Impact Resistant (LIR) Structural Mounting requirements shall apply to steady burning and sequenced flasher light assemblies.	FAA Order 6850.2A, Section 201.a	
240.	3.2.2.6.3	The light assembly mounting base shall allow for the elevated mounting light assembly on an LIR structure.	FAA Order 6850.2A, Section 201.a	
241.	3.2.2.6.3.1	The steady burning light assembly mounting base in a given light bar shall interface with the LIR by connecting to the T-M Tee-Bar IAW D-6292-13, D-6292-14, and D-6155-2.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
242.	3.2.2.6.3.1	The sequenced flasher light assembly mounting base shall interface with the LIR by fitting into the LIR tube cap T-1 assembly as specified in D-6292-13 and D-6213-15.	NAS-SS-1000, Vol. 3, Section 3.2.1.4.4.1.3	
243.	3.2.3	All MALSR power and signal interfaces shall use terminal blocks.	FAA-G-2100g, Section 3.1.2.4.1.a	
244.	3.2.3	Terminal blocks shall be the enclosed base type terminal blocks using pressure plate type terminal connectors.	<b>ORPHAN</b>	Good Design Practice

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245.	3.2.3	Terminal blocks shall have ten (10) percent unused terminals, but not less than two (2) extra terminals per terminal block.	NAS-SS-1000, Vol. 1, Section 3.3.8	
246.	3.2.3	Power terminal blocks shall have a minimum of six (6) inches clear space at the input and output terminals.	FAA-G-2100g, Section 3.1.2.4.1.a	
247.	3.2.3	Control terminal blocks shall have a minimum of four (4) inches clear space at the input and output terminals.	FAA-G-2100g, Section 3.1.2.4.1.a	
248.	3.2.3.1	All terminal blocks shall have a polycarbonate, acrylic, or similar transparent, non-conductive material protective covers.	FAA-G-2100g, Section 3.3.5.1.a	
249.	3.2.3.1	The protective cover shall have meter probe access holes for all terminals to aid in maintenance.	FAA-G-2100g, Section 3.3.5.1.a	
250.	3.2.4	An elapsed time meters shall be installed in the control cabinet to indicate the number of hours of operation.	NAS-SS-1000, Vol. 1, Section 3.2.2.1	
251.	3.2.4	The elapsed time meter shall not be re-settable.	NAS-SS-1000, Vol. 1, Section 3.2.2.1	
252.	3.2.4	The elapsed time meter shall allow the counter to recycle back to zero once the system has exceeded the maximum measured elapsed time.	NAS-SS-1000, Vol. 1, Section 3.2.2.1	
253.	3.2.4	The elapsed time meter shall accumulate elapsed time in hours and tenths of hours over the range of 0 to 99,999.9 hours.	NAS-SS-1000, Vol. 1, Section 3.2.2.1	
254.	3.2.4	The accumulated time in the elapsed time meter shall be retained regardless of system power status.	NAS-SS-1000, Vol. 1, Section 3.2.2.1	
255.	3.2.5	The MALSR control cabinet shall contain a locally actuated 120 VAC, Standard Edison Light Bulb Socket.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
256.	3.2.5	The maintenance light shall function even when the MALSR main disconnect circuit breaker is off.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
257.	3.2.5	Supplemental enclosures shall contain a locally actuated 120 VAC, Standard Edison Light Bulb Socket.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
258.	3.2.5	The supplemental enclosure maintenance light shall be connected to the power provided from the applicable power interface from the MALSR control cabinet.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
259.	3.2.5	The maintenance light shall be sufficient to illuminate the entire control cabinet or supplemental enclosure for maintenance purposes.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability

<b>REQ NUMBER</b>	<b>Section</b>	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	<b>Parent Requirement(s)</b>	<b>Notes</b>
260.	3.2.5	The maintenance light shall be protected from damage due to inadvertent impact with standard maintenance tools.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
261.	3.2.5	The maintenance light shall be protected with either a dedicated fuse and activated with a dedicated on/off switch or a single pole circuit breaker.	<b>ORPHAN</b>	Good Design Practice, Design for Serviceability
262.	3.2.5	A fuse, if used, shall meet the fuse, fuse-holder, and associated hardware requirements as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.3.1.3.4	
263.	3.2.5	A circuit breaker, if used, shall meet the circuit breakers requirements as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.3.1.3.2	
264.	3.2.6	The control cabinet shall contain a 120 VAC duplex convenience receptacle.	FAA-G-2100g, Section 3.1.1.1.1.f	
265.	3.2.6	The receptacle in the control cabinet shall function even when the MALSR main disconnect circuit breaker is off.	FAA-G-2100g, Section 3.1.1.1.1.f	
266.	3.2.6	Supplemental enclosures shall contain a 120 VAC duplex convenience receptacle.	FAA-G-2100g, Section 3.1.1.1.1.f	
267.	3.2.6	The receptacle in the supplemental enclosure shall be connected to the power provided from the applicable power interface within the MALSR control cabinet.	FAA-G-2100g, Section 3.1.1.1.1.f	
268.	3.2.6	The receptacle shall be a NRTL listed UL943-93 Ground Fault Circuit Interrupter (GFCI) type electrical outlet, rated for 15 amps minimum, and containing a manual set and reset function.	FAA-G-2100g, Section 3.1.1.1.1.f	
269.	3.2.6	The duplex convenience receptacle shall be protected with a dedicated 15-amp fuse housed in an illuminated base.	FAA-G-2100g, Section 3.1.1.1.1.f	
270.	3.2.6	The duplex convenience receptacle shall meet the convenience outlet requirements as specified in FAA-G-2100g.	FAA-G-2100g, Section 3.1.1.1.1.f	
271.	3.2.6	The receptacle shall be located in an unobstructed area within the control cabinet or supplemental enclosure.	FAA-G-2100g, Section 3.1.2.4.1.a	
272.	3.3	Unless otherwise specified, all power circuitry, cabling, wiring, and enclosures shall be approved by a Nationally Recognized Testing Laboratory (NRTL) and meet NFPA 70 requirements.	FAA-G-2100g, Section 3.1.1.b	
273.	3.3.1	The MALSR system shall use solid-state switches for all control and electrical switching components with the exception of circuit breakers.	<b>ORPHAN</b>	Eliminates problem with the contacts pitting on the switches.

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274.	3.3.1	MALSR switching control shall be accomplished using microprocessors.	<b>ORPHAN</b>	Eliminates problem with the contacts pitting on the switches.
275.	3.3.1	Programmable elements shall not be remotely acceptable.	<b>ORPHAN</b>	Good Design Practice - Security
276.	3.3.1.1	The solid state switching device shall remain active for 100 ms following a power interruption to avoid inadvertent system outages	<b>ORPHAN</b>	Pulled from "Quick Look Report for NBP MALSR Solid State Switcher Evaluation" from NAVVAID Engineering dtd 10/14/2004
277.	3.3.1.1	The solid state switching devices shall automatically reset on power up, or in the event of power interruption	<b>ORPHAN</b>	Pulled from "Quick Look Report for NBP MALSR Solid State Switcher Evaluation" from NAVVAID Engineering dtd 10/14/2004
278.	3.3.2	All material used in the construction and assembly of components and circuits operating above 6,000 volts, including the insulation of wires that are to be located near or in the sequenced flasher lamp chamber, shall be ozone resistant.	<b>ORPHAN</b>	
279.	3.3.3	MALSR cables used in high voltage circuits shall have no more than 1 mA of leakage current when subjected to twice normal circuit voltage plus 1,000 volts at the circuit frequency for one minute.	<b>ORPHAN</b>	
280.	3.3.4	All grounding shall be IAW the National Electric Code and as outlined in FAA-STD-019d Paragraphs 3.12 and 3.13.	FAA-STD-019d, Section 3.12	
281.	3.3.4	All bonding shall be IAW FAA-STD-019d Paragraph 3.14.	FAA-STD-019d, Section 3.13	
282.	3.3.4	All shielding shall be IAW FAA-STD-019d Paragraph 3.15.	FAA-STD-019d, Section 3.14	
			FAA-STD-019d, Section 3.15	

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283.	3.3.5	Equipment nameplates and marking shall be IAW FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.3.3 FAA-G-2100g, Section 3.3.3	
284.	3.3.5	System wiring and marking shall be IAW FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.3.3 FAA-G-2100g, Section 3.3.1.3.10	
285.	3.3.5	Wiring markings and conductor identification shall be IAW NFPA No. 70, articles 310.11 and 310.12.	NAS-SS-1000, Vol. 1, Section 3.3.3	
286.	3.3.6	The MALSR system lightning protection shall be IAW the lightning protection system requirements as specified in FAA-STD-019D.	FAA-STD-019D, Section 3.7	
287.	3.3.9	MALSR system cables (power and signal), external to the facility, shall be selected based on the requirements specified in NFPA No. 70, Article 310.	FAA-G-2100g, Section 3.1.1.b	
288.	3.4.1	All equipment used in the MALSR system shall be designed for outdoor installation.	NAS-ASS-1000, Vol. 3, Section 3.2.1.4.4.1.1 FAA Order 6850.2A, Section 200.f	
289.	3.4.1	The MALSR system shall operate continuously or intermittently under the environmental conditions specified below.	NAS-SS-1000, Vol. 1, Section 3.2.5	
290.	3.4.1	The system shall be capable of performing satisfactorily under the Common Outdoor Operating Environmental Conditions as specified in FAA-G-2100g except where the requirements in the following subsections differ.	NAS-SS-1000, Vol. 1, Section 3.2.5	
291.	3.4.1.1	The system shall exhibit no adverse effects during operation at temperature ranges at all specified climate categories in Table C-1 of MIL-STD-810F.	NAS-SS-1000, Vol. 1, Section 3.2.5	
292.	3.4.1.2	The system shall exhibit no adverse effects during operation at relative humidity levels over all climate categories defined in Table C-1 of MIL-STD-810F.	NAS-SS-1000, Vol. 1, Section 3.2.5	
293.	3.4.1.3	The system shall exhibit no adverse effects during operations at an altitude range from -300 feet (-92 meters) to 10,000 feet (3,048 meters) as specified in FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.2.5	
294.	3.4.1.4	The system shall exhibit no adverse effects during exposure to wind blown sand and dust particles of 5,700 feet/minute (ft/min) (29 meters/second (m/s) and 1,750 ft/min (8.9 m/s) respectively.	NAS-SS-1000, Vol. 1, Section 3.2.5	
295.	3.4.1.5	The system shall operate under exposure to salt-laden atmosphere with relative humidity as stated in 3.4.1.2.	NAS-SS-1000, Vol. 1, Section 3.2.5	

<b>REQ NUMBER</b>	<b>Section</b>	<b>Requirement Statement</b> Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	<b>Parent Requirement(s)</b>	<b>Notes</b>
296.	3.4.1.6	The system shall operate under exposure to wind blown rain at rain rates up to 4 inches/hour (in/h) (10 centimeters/hour (cm/h)) and wind velocities up to 40 miles/hour (mph) (18 meters/second).	NAS-SS-1000, Vol. 1, Section 3.2.5	
297.	3.4.1.7	The system shall withstand exposure of external surfaces (including the light windows) to sudden application of cold [0° C to 5° C (32° F to 41° F)] water when the lights reach stable temperatures in the high intensity mode.	NAS-SS-1000, Vol. 1, Section 3.2.5	
298.	3.4.1.8	The system shall operate under exposure to sunshine as specified for all climate categories as defined in Table C-1 of MIL-STD-810F.	NAS-SS-1000, Vol. 1, Section 3.2.5	
299.	3.4.1.9	Any MALSRS component intended to be used in the light plane shall be capable of withstanding vibrations as defined by Procedure 514.5, Figure C-14 in MIL-STD-810F using the parameters presented in TABLE X.	NAS-SS-1000, Vol. 1, Section 3.2.5	
300.	3.4.1.10	The system shall operate normally with 0.5-inch radial ice load in winds of 100 mph.	NAS-SS-1000, Vol. 1, Section 3.2.5	
301.	3.4.1.11	The system shall operate and exhibit no adverse effects encased in clear ice up to 0.5 in. thick (radial).	NAS-SS-1000, Vol. 1, Section 3.2.5	
302.	3.4.1.12	MALSRS light sources shall not allow the accumulation of ice on the face of the light source when exposed to an ambient air temperature of -10° C ±2° C and water droplet temperature of 0° C ±3° C.	NAS-SS-1000, Vol. 1, Section 3.2.5	
303.	3.4.2	The system shall not be damaged when stored or transported under conditions delineated in the non-operating conditions as specified in FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.2.5	
304.	3.5.1	The MALSRS equipment shall provide Electromagnetic Interference protection IAW the shielding requirement specified in FAA-STD-019d.	NAS-SS-1000, Vol. 1, Section 3.3.2	
305.	3.5.1.1	Conducted Emission Interference levels from the MALSRS system shall be no greater than the limits for CE102 as defined in MIL-STD-461. The frequency range shall be 10 kilohertz (kHz) to 10 megahertz (MHz).	NAS-SS-1000, Vol. 1, Section 3.3.2	
306.	3.5.1.2	Radiated emission interference levels from the MALSRS system shall be no greater than the limits for RE102 as defined in MIL-STD-461 with the exception that the frequency range tested shall be 2 MHz to 10 gigahertz (GHz).	NAS-SS-1000, Vol. 1, Section 3.3.2	

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307.	3.5.1.2	The RE102 limit shall be IAW Figure RE102-4 for ground applications.	NAS-SS-1000, Vol. 1, Section 3.3.2	
308.	3.5.1.2	If the emission measurement is made at a distance other than 1 meter, as described in MIL-STD-461, the RE102 limit line of Figure RE102-4 shall be adjusted, over the frequency range measured, for the distance at which the measurement is taken.	NAS-SS-1000, Vol. 1, Section 3.3.2	
309.	3.5.1.3	The MALSR system shall meet the conducted susceptibility requirements of CS114 specified in MIL-STD-461.	NAS-SS-1000, Vol. 1, Section 3.3.2	
310.	3.5.1.3	The frequency range shall be 10 kHz to 400 MHz, and Curve #2 of Figure CS114-1 of MIL-STD-461 shall be used for the limit IAW Table III for Air Force (AF) Ground Equipment.	NAS-SS-1000, Vol. 1, Section 3.3.2	
311.	3.5.1.4	The MALSR system shall meet the Radiated Susceptibility requirements of RS103 defined in MIL-STD-461. The frequency range shall be 2 MHz to 10 GHz.	NAS-SS-1000, Vol. 1, Section 3.3.2	
312.	3.5.1.4	The electric field intensity shall be IAW the limits for AF ground equipment to Table VII RS103 limits for AF Ground Equipment of MIL-STD-461.	NAS-SS-1000, Vol. 1, Section 3.3.2	
313.	3.6	The MALSR system, subsystems, and circuitry shall provide ESD protection to reduce the frequency of ESD events and to minimize the effects as specified in FAA-STD-019d.	NAS-SS-1000, Vol. 1, Section 3.3.2	
314.	3.6	All electronic circuitry that contain miniaturized or solid-state components shall be considered ESD susceptible.	FAA-STD-019d, Section 3.16	
315.	3.7	System maintainability shall be in conformance with the maintainability requirements as specified in FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.2.3	
316.	3.7	Diagnosis of a MALSR Failure shall be no greater than 0.50 hours	NAS-SS-1000, Vol. 1, Table 3.2.2.1-1	
317.	3.7	The Mean-Time-To-Repair (MTTR) requirement shall be no greater than 0.50 hour after determination of the failure.	NAS-SS-1000, Vol. 1, Table 3.2.2.1-1	
318.	3.7	The Mean Periodic Maintenance Time (MPMT) shall be no greater than 2 hours per calendar quarter, including routing inspection.	NAS-SS-1000, Vol. 1, Section 3.2.3.2	
319.	3.7	MTTR and MPMT shall be measured from when the FAA Technician arrives on site to when the MALSR system is operational.	NAS-SS-1000, Vol. 1, Table 3.2.2.1-1 NAS-SS-1000, Vol. 1, Section 3.2.3.2	

REQ NUMBER	Section	Requirement Statement Note: If there are any discrepancies between the requirement statement in this appendix and Section 3, the verbiage in Section 3 takes precedence.	Parent Requirement(s)	Notes
320.	3.8	Test points shall be provided to allow measurement of performance parameters that confirm proper operation, and identify failed or faulty (performing out of specification) LRU while the system is operational.	FAA-G-2100g, Section 3.2.4	
321.	3.8	Light sources shall be LRUs.	FAA-G-2100g, Section 3.1.2.4.3	
322.	3.8	All test points and built-in test capabilities shall conform to the maintainability requirements as specified in FAA-G-2100g.	FAA-G-2100g, Sections 3.2.4.f-3.2.1.1	
323.	3.9.1	The MALSRS system level Mean Time Between Failures (MTBF) shall be greater than 2,500 hours, with an objective of 25,000 hours.	NAS-SS-1000, Vol. 1, Table 3.2.2.1-1	No Engineering Data to support Objective System MTBF of 25,000 hours.
324.	3.9.2	MALSRS structures, enclosures, and components as defined in TABLE I shall be designed for thirty (30) years of use.	<b>ORPHAN</b>	LIR Structures are designed for a Service life of 20 yts (FAA-E-2702).
325.	3.10	The system shall meet the personal safety and health requirements specified in FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.3.6 FAA-G-2100g, Section 3.3.5	
326.	3.11	The MALSRS system shall be fail safe as defined in FAA-G-2100g.	NAS-SS-1000, Vol. 1, Section 3.2.4.1 FAA-G-2100g, Section 6.2.3	
327.	3.12	The MALSRS system shall conform to the thermal design requirements of FAA-G-2100g.	FAA-G-2100g, Section 3.1.2.5.f	
328.	3.14	Materials that are nutrients for fungi shall not be used.	<b>ORPHAN</b>	